



**REPORT
REMEDIAL INVESTIGATION - PHASE II**

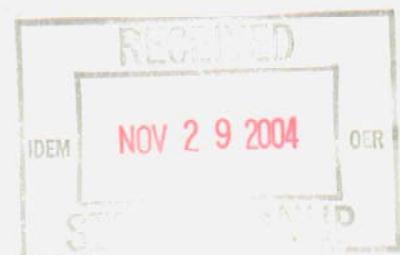
**TUCHMAN CLEANERS
4410 NORTH KEYSTONE AVENUE
INDIANAPOLIS, INDIANA**

Prepared for:

**TUCHMAN CLEANERS
INDIANAPOLIS, INDIANA**

**JOB NO.: 14944888
NOVEMBER 24, 2004**

36 East 7th Street, Suite 2300
Cincinnati, Ohio 45202
Voice (513) 651-3440
Fax (513) 651-3452



CONTENTS

Section	Page
ACRONYMS.....	i
1.0 INTRODUCTION.....	1
1.1 FACILITY LOCATION AND CONTACTS.....	1
1.2 CURRENT CONDITIONS.....	2
1.2.1 Interim Remedial Actions.....	2
1.2.1.1 Dissolved-Phase Pump and Treat.....	3
1.2.1.2 DNAPL Recovery System.....	3
2.0 SITE BACKGROUND AND BASELINE PROJECT ASSESSMENT.....	5
2.1 SITE HISTORY.....	5
2.1.1 Previous Investigations.....	5
2.2 GEOGRAPHY.....	5
2.3 GEOLOGY.....	6
2.4 HYDROGEOLOGY.....	6
2.5 REGIONAL ECOLOGY AND POTENTIAL ECOLOGICAL EXPOSURE.....	7
2.6 POTENTIALLY SUSCEPTIBLE AREAS.....	9
2.7 POSSIBLE CHEMICALS OF CONCERN.....	10
2.8 POTENTIAL CONTAMINANT TRANSPORT.....	10
2.9 POTENTIAL HUMAN EXPOSURE PATHWAYS.....	10
3.0 STATEMENT OF WORK.....	12
3.1 INVESTIGATION OBJECTIVES.....	12
3.2 INVESTIGATION ACTIVITIES AND METHODS.....	12
3.2.1 Stage I Field Activities.....	13
3.2.1.1 Off-Site Groundwater Assessment.....	13
3.2.1.2 Deep Piezometer Pre-Analysis and Installation.....	14
3.2.1.3 Hydraulic Testing.....	14
3.2.1.4 Interior Source Area Borings.....	15
3.2.1.5 Monitoring Well Sampling.....	16
3.2.1.6 Analytical Testing.....	17
3.2.2 Stage II Field Activities.....	17
3.2.2.1 Intermediate Monitoring Well Installation.....	17
3.2.2.2 Groundwater Sampling.....	18
3.2.2.3 Interior Source Area Borings.....	19
3.3 INVESTIGATION SCHEDULE.....	20
4.0 PROJECT INVESTIGATION METHODS.....	21
5.0 INVESTIGATION RESULTS.....	22
5.1 SUBSURFACE GEOLOGY.....	22
5.1.1 Fill Material.....	23
5.1.2 Upper Clay Unit (T-3).....	24
5.1.3 Shallow Groundwater Zone.....	24
5.1.4 Upper Till Unit (T-2).....	25
5.1.5 Intermediate Groundwater Zone.....	26
5.1.6 Lower Till Unit (T-1).....	26
5.1.7 Deep Groundwater Zone.....	27
5.1.8 Pre-glacial Residuum.....	27
5.1.9 Devonian-Aged Bedrock.....	27
5.2 HYDROGEOLOGY.....	28
5.2.1 Hydraulic Testing Results.....	28
5.2.2 Shallow Groundwater Zone.....	30
5.2.3 Intermediate Groundwater Zone.....	31
5.2.4 Deep Groundwater Zone.....	32

CONTENTS
(Continued)

5.3	NATURE AND EXTENT OF SOIL IMPACT	32
5.3.1	Shallow Probes and Piezometers	33
5.3.2	Intermediate and Deep Soil Samples	34
5.4	NATURE AND EXTENT OF GROUNDWATER IMPACT	34
5.4.1	Shallow Groundwater Zone	34
5.4.2	Intermediate Groundwater Zone	35
5.4.3	Deep Groundwater Zone	37
5.5	DNAPL EVALUATION.....	37
6.0	CONCLUSIONS.....	38
6.1	NATURE AND EXTENT OF OFFSITE IMPACT (SHALLOW GROUNDWATER ZONE).....	38
6.2	NATURE AND EXTENT OF IMPACT TO THE INTERMEDIATE GROUNDWATER ZONE.....	38
6.3	GROUNDWATER FLOW CONDITIONS.....	39
6.4	FURTHER EVALUATION OF EXTENT OF DNAPL IMPACT	40
7.0	REFERENCES.....	41

TABLES
(follow text)

Number

- 1 CONTAMINANT REMOVAL EVALUATION-RW-1, DECEMBER 1995 THROUGH
NOVEMBER 2004 – REMEDIAL INVESTIGATION – PHASE II
- 2 CONTAMINANT REMOVAL EVALUATION-DNAPL REMOVAL - REMEDIAL
INVESTIGATION – PHASE II
- 3 GROUNDWATER ELEVATIONS FIELD ACTIVITIES
REMEDIAL INVESTIGATION – PHASE II
- 4 GROUNDWATER DRAWDOWN EVALUATION – RW-1 PUMP TEST
STAGE I FIELD ACTIVITIES - REMEDIAL INVESTIGATION – PHASE II
- 5 ANALYTICAL RESULTS SUMMARY SOIL SAMPLING
REMEDIAL INVESTIGATION PHASE II
- 6 ANALYTICAL RESULTS SUMMARY GROUNDWATER SAMPLING – STAGE I OFFSITE
PROBE INVESTIGATION FEBRUARY TO APRIL 2004
REMEDIAL INVESTIGATION - PHASE II
- 7 ANALYTICAL RESULTS SUMMARY INTERIOR SOURCE AREA GROUNDWATER
SAMPLING FEBRUARY AND AUGUST 2004 REMEDIAL INVESTIGATION – PHASE II
- 8 ANALYTICAL RESULTS SUMMARY GROUNDWATER SAMPLING – STAGE I FIELD
ACTIVITIES, APRIL 6-8, 2004 EVENT REMEDIAL INVESTIGATION – PHASE II
- 9 ANALYTICAL RESULTS SUMMARY GROUNDWATER SAMPLING – STAGE II FIELD
ACTIVITIES, SEPTEMBER 13-14, 2004 EVENT REMEDIAL INVESTIGATION – PHASE II

CONTENTS
(Continued)

FIGURES
(follow tables)

Number

- 1 SITE VICINITY MAP SHOWING PROBE, PIEZOMETER, AND WELL LOCATIONS
- 2 SITE LAYOUT MAP WITH CROSS SECTION LOCATION
- 3 GEOLOGIC CROSS SECTION A-A'
- 4 GEOLOGIC CROSS SECTION B-B'
- 5 UPPER TILL UNIT (T-2) SURFACE MAP
- 6 INTERIOR BORING (IB) LOCATIONS AND UPPER TILL UNIT (T-2) SURFACE MAP
- 7 PIEZOMETRIC SURFACE MAP SHALLOW GROUNDWATER ZONE
RW-1 PUMPING CONDITIONS (APRIL 6, 2004)
- 8 POTENTIOMETRIC SURFACE MAP INTERMEDIATE GROUNDWATER
ZONE UNDER FC-11 PUMPING CONDITIONS SEPTEMBER 13, 2004
- 9 MONITORING WELL GROUNDWATER LEVEL RESPONSE HYDRAULIC TESTING
STAGE I EVENTS
- 10 POTENTIOMETRIC SURFACE MAP DEEP GROUNDWATER ZONE
- 11 CVOC CONCENTRATION MAP SHALLOW GROUNDWATER ZONE STAGE I EVENTS
- 12 CVOC CONCENTRATION MAP SEPTEMBER 13 AND 14, 2004 INTERMEDIATE AND
DEEP GROUNDWATER ZONE STAGE I EVENTS
- 13 PROJECTED DNAPL EXTENT

APPENDICES
(follow figures)

Appendix

- A BORING LOGS
- B IDNR WELL LOGS
- C SURVEY DATA, BEACON SURVEYING & ENGINEERING
- D ANALYTICAL REPORTS (Submitted on CD)

ACRONYMS

ADS	American Drilling Services
ASTM	American Standard Test Method
ATV	All-terrain vehicle
bgs	Below ground surface
°C	Degrees Celsius
COC	Contaminant of concern
CVOCs	Chlorinated volatile organic compounds
cis-1,2-DCE	cis-1,2-Dichloroethene
1,1-DCE	1,1-Dichloroethene
trans-1,2-DCE	trans-1,2-Dichloroethene
DNAPL	Dense non-aqueous phase liquid
ESRI/FEMA	Environmental Systems Research Institute/Federal Emergency Management Agency
°F	Degrees Fahrenheit
gpd	Gallons per day
gpm	Gallons per minute
HCl	Hydrochloric acid
ID	Inner diameter
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IWC	Indianapolis Water Company
IWP	Investigation Work Plan
Kemark	Kemark Environmental Services, Inc.
MCLs	Maximum contaminant levels
mg/L	Milligrams per liter
msl	Mean sea level
ORP	Oxidation-reduction potential
OSHA	Occupational Safety Health Administration
PCE	Tetrachloroethene
PE	Polyethylene
PID	Photoionization detector
ppm	Parts per million
PVC	Polyvinyl chloride

QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
RISC	Risk Integrated System of Closure
STL	Severn Trent Laboratories
TCE	Trichloroethene
Tuchman	Tuchman Cleaners
USCS	Unified Soil Classification System
U.S. EPA	United States Environmental Protection Agency
U.S. FWS	U.S. Fish and Wildlife Service
UV	Ultraviolet
UTM	Universal Transverse Mercator
Veolia	Veolia Water Company
VOCs	Volatile organic compounds

1.0 INTRODUCTION

This Remedial Investigation, Second Phase (RI-Phase II) Report presents the procedures and results of a continuing subsurface soil and groundwater investigation at the Tuchman Cleaners (Tuchman) facility located at 4401 North Keystone Avenue in Indianapolis, Indiana. This second phase investigation was outlined in the Phase II RI Work Plan dated August 19, 2003 and conducted as a continuation of the Investigation Work Plan (IWP) for the aforementioned facility dated March 4, 2002.

This RI-Phase II Report was prepared in accordance with the Indiana Department of Environmental Management (IDEM) State Cleanup Program requirements following the outline prescribed in Appendix 1 of the Risk Integrated System of Closure (RISC) User's Guide dated February 15, 2001.

The site is identified as Incident # 1991-02-503 and is currently under the review of the State Cleanup Program within IDEM.

1.1 FACILITY LOCATION AND CONTACTS

The Tuchman facility is located on the northeast corner of Keystone Avenue and 44th Street within the city limits of Indianapolis in Marion County, Indiana as illustrated in Figure 1. The layout of the facility is illustrated in Figure 2.

The Facility Name and Contact information is provided below:

Site: Tuchman Cleaners
4401 North Keystone Avenue
Indianapolis, IN 46205-2246
Site Contact: Mr. Jim Dunn

Contacts:	<u>Owner's Representative</u>	<u>Party Responsible for Investigation</u>
	Mr. Randy Jackson	Mr. Dennis Connair
	National Dry Cleaners, Inc.	URS Corporation
	4510 W. 63th Terrace	36 E. 7 th Street, Suite 2300
	Prairie Village, KS 66208	Cincinnati, Ohio 45202
	(913) 617-7546	(513) 651-3440

1.2 CURRENT CONDITIONS

As stated in the RI Report, testing to date has identified the presence of chlorinated volatile organic compounds (CVOCs) on site. The primary contaminant of concern (COC) is the CVOC tetrachloroethene (PCE), which is a solvent historically and currently used on site for dry cleaning operations as discussed in Section 2.1 of the RI Report (dated April 4, 2003). Other COCs are breakdown products of PCE: trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride. Other potential contaminant issues include reported former storage of Stoddard solvents (mineral spirits) and fuel (diesel and gasoline) on site, but numerous rounds of testing have not detected volatile components of either Stoddard or fuels on site at concentrations warranting further investigation.

Impact from PCE and associated CVOCs is concentrated within the upper 25 feet of the subsurface (encompassing the uppermost groundwater zone) on the west and southwestern portion of the site at parts-per-million (ppm) range concentrations. Soil and groundwater sampling at 18 offsite locations to the west and southwest of the facility have also identified the presence of the CVOCs at ppm-range concentrations. These locations define the downgradient contaminant plume in the uppermost aquifer. Impact has been identified in intermediate and deep groundwater zones within the site property at concentrations significantly below those observed in the uppermost zone. Offsite impact to the deep and intermediate zones has not been identified.

The known nature and extent of this impact is fully described in Section 5.0 of this report.

Concentrations of PCE at upgradient monitoring well MW-6 have increased over time. This monitoring well is located downgradient of a neighboring laundry facility on Allisonville Road that included dry cleaning operations that may have resulted in releases to the subsurface.

1.2.1 Interim Remedial Actions

Interim remediation is being conducted by pumping and treatment of dissolved-phase impact to shallow groundwater at the downgradient property boundary, and by pumping and recycling of dense non-aqueous phase liquid (DNAPL) from the shallow groundwater zone under the facility. A brief summary of the nature of these actions and the resultant effects follows.

1.2.1.1 Dissolved-Phase Pump and Treat

Groundwater is pumped from recovery well RW-1 at the southwest corner of the Tuchman property (Figure 1) to an ORS Lo-Pro™ II air stripping unit, where volatile organic compounds (VOCs) are removed from the liquid. The system is operated primarily as a containment measure to prevent the offsite migration of VOCs dissolved in groundwater. The air stripper system has operated at approximately 10 gallons per minute (gpm) since 1995, except when interrupted by maintenance, upgrade, and cleaning activities. Upgrades within the past year included underground pipe replacement, in-well pump installation, increased pumping capacity, and installation of additional process controls. Extraction well RW-1 was also cleaned in 2003 and 2004 to maintain its production. Treated groundwater is discharged with the permission (Permit #721650) of the City of Indianapolis Department of Public Works.

Samples of the groundwater influent and treated liquid are tested monthly to evaluate air stripper performance and to verify that the concentration of VOCs in the liquid effluent is below the discharge limit of 1 ppm. Approximately 40,000,000 gallons of groundwater have been extracted and treated since 1995, removing an estimated total of 530 pounds of VOCs from the uppermost water-bearing zone. Table 1 is a summary of groundwater extraction and air stripping results.

1.2.1.2 DNAPL Recovery System

Subsequent to the submittal of the RI report, dated April 4, 2003, a less than 1/2-foot thick DNAPL layer was observed 28 feet below ground surface (bgs) in the newly installed recovery well RW-3 (installed in February 2003 as part of the Stage II activities of the original RI investigation).

Manual pumping of DNAPL was conducted at RW-3 with a peristaltic pump in October and November 2003 to evaluate the extent to which DNAPL would be recoverable if an automated pumping system were to be installed. Nearly 13 gallons (175 pounds) of DNAPL were recovered during 12 hours of pumping; consequently, an automatic DNAPL pumping system (Pumpworks, Inc. dual-solenoid electric pump) was installed in late November 2003 at RW-3. Within 15 days, approximately 55 gallons (700 pounds) of DNAPL was recovered. Minor pump problems (overheating) prevented pumping DNAPL between mid December and early January 2004. When the pump was successfully reactivated, an additional 55 gallons of DNAPL was pumped by mid February 2004.

Approximately 1,825 pounds of DNAPL have been removed to date by manual and automatic recovery, as detailed in Table 2. Two 55-gallon drums of DNAPL have been transported to Parts Cleaning Technologies of Indianapolis, Indiana for recycling. A third 55-gallon drum continues to accumulate DNAPL from the automatic pumping system, however the DNAPL recovery rate has decreased to less than 1/10th of a gallon per day [gpd] (0.14 pounds per day), indicating that pooled DNAPL has been reduced to a relatively thin layer in the vicinity of RW-3. Once DNAPL has been reduced sufficiently, groundwater may be pumped from RW-3 to the existing air stripping system; groundwater will likely require treatment prior to the air stripping system to meet discharge limits.

2.0 SITE BACKGROUND AND BASELINE PROJECT ASSESSMENT

2.1 SITE HISTORY

As discussed in the RI report, Tuchman has been the sole occupant of the property at 4401 North Keystone Avenue for over 50 years. Operations have included dry cleaning; cleaning of draperies; leather and suede cleaning; and wet washing of laundry, commercial uniforms, and floor mats. Detailed accounting of past activities is discussed in Section 2.1 of the RI report.

2.1.1 Previous Investigations

Previous investigations on site have been conducted by Alt & Witzig between 1989 and 1993 and by URS (formerly Dames & Moore) from 1994 to present. A chronology of the previous investigations and summaries of soil and groundwater analytical results is presented in the RI report.

2.2 GEOGRAPHY

The facility is located within the city limits of Indianapolis in Washington Township, Marion County, Indiana. The Land Office Grid System location for the facility is the southwest corner of the northwest corner of Section 17 in Township 16N and Range 4E. The measured Universal Transverse Mercator (UTM) coordinates are 4,409,950 meters North and 575,125 meters East in UTM Zone 16.

The site is located within the Tipton Till Plain section of the Central Lowlands physiographic province. The section is characterized by relatively flat till-covered uplands occasionally cut by deep, steep-sided glacial valleys that have been partially or wholly filled with glacial alluvium. The site is situated within one such buried glacial valley trending northeast-southwest, currently occupied by Fall Creek, a tributary to the White River valley system west of the site.

The Environmental Systems Research Institute/Federal Emergency Management Agency (ESRI/FEMA) Project Impact Flood Hazard Map does not identify the site as being situated within the 100-year or 500-year floodplains of Fall Creek (ESRI/FEMA, 2000).

2.3 GEOLOGY

According to the Soil Survey of Marion County, Indiana (Sturm and Gilbert, 1978), the soil present on site is classified as Urban land-Westland Complex, a loamy outwash that contains a clay loam within the upper 30 inches. This soil complex is characterized as having very slow runoff and slow permeability.

According to the *Hydrogeologic Framework of Marion County, Indiana: A Digital Atlas Illustrating Hydrogeologic Terrain and Sequence* (Indiana Geological Survey, 2000), the general area is underlain by a thick, complex collection of glacial deposits over Devonian-aged carbonate bedrock. The unconsolidated sediments were generated during a complex sequences of Quaternary-aged glacial advances over the region. The associated depositional environments that helped form the sediments include buried pre-glacial valleys that were filled by periglacial outwash deposits, alluvial fans, silt/clay-rich till, and silty lacustrine deposits in alternating layers.

The data presented in borings logs of the monitoring wells and soil borings advanced on site identify three distinct sand and gravel units within the subsurface that are separated by relatively impermeable glacial till units. Devonian-aged carbonate bedrock was encountered at 70 to 72 feet bgs on site.

Detailed descriptions of the subsurface encountered during the investigation field activities is provided in Section 5.1.

2.4 HYDROGEOLOGY

According to the *Water Resources of Marion County, IDNR, 1974*, the alluvium of the Fall Creek valley constitutes an aquifer capable of yielding several hundred gpm to properly installed wells. The bedrock aquifer within the Devonian-aged limestones is reportedly capable of yielding 75 to 250 gpm.

Water well logs obtained from the Indiana Department of Natural Resources (IDNR) support this characterization, but indicate that the alluvial aquifer is highly variable in the site vicinity. In particular, the alluvium is typically divided into two or more water bearing zones separated by clay-rich units. In this area, only the deepest groundwater zones are used for water supply. The

most productive wells are located west of the site where the deep sand and gravel unit is thicker, or they are completed in the bedrock at more widespread locations. On site, three distinct groundwater zones have been identified corresponding to the three sand and gravel units above the bedrock aquifer discussed above.

Pumping tests conducted by URS in 1995 (Dames & Moore, 1996) indicate that the hydraulic conductivity of the shallow groundwater zone is on the order of 4.0×10^{-4} cm/second with a storage coefficient of 0.01 (semiconfined conditions). No significant hydraulic response to the test was discernable in the intermediate and deep zone wells at MW-9, suggesting that the lower zones are not significantly connected to the shallow zone.

Slug tests conducted on intermediate wells MW-9I (formerly MW-9D(A)) and MW-6I derived hydraulic conductivity values of 1.7×10^{-4} and 5.1×10^{-4} cm/second, respectively.

The results of the testing conducted in March 2004 identified a strong hydraulic connection between the Indianapolis Water Company's (IWC's) bedrock well FC-11 and the intermediate and deep groundwater zones present on site. However, the shallow groundwater zone did not hydraulically respond to FC-11 production, again suggesting a hydraulic barrier between the shallow and the lower groundwater zones.

Further discussion of the hydrogeologic data collected during the investigation is provided in Section 5.2.

2.5 REGIONAL ECOLOGY AND POTENTIAL ECOLOGICAL EXPOSURE

URS conducted a preliminary evaluation of the potential ecological effects of the CVOCs identified on site. The study, presented in the Phase I RI Report, identified the following conclusions:

- Based upon the nature and degree of site vicinity development, significant wildlife populations would not be expected on site.
- Because currently identified CVOC impacts are limited to subsurface soils and groundwater, contaminant exposure via soil ingestion/dermal contact would not be expected unless impacted subsurface soils were exposed.

- Because potable water supply is generally provided, it is available to residents and businesses in the area by Veolia Water Company, there is limited opportunity for ingestion or dermal contact with impacted groundwater underlying the site.
- Periodic monitoring of vapor concentrations in the work space has been conducted as recently as summer 2002, indicating that the vapor concentration in the working atmosphere was within applicable limits set forth by the Occupation Safety and Health Administration (OSHA).
- Mr. Ron Hellmich, Ecologist with the IDNR Division of Nature Preserves did not report any known or potential threatened or endangered species of vascular plants, insects, amphibians or birds likely to be present in the site vicinity. Known or potential threatened, endangered and species of special concern in the site vicinity could include Kirtland's Snake and the Eastern Sand Darter.
- Kirtland's Snake (*Clonophis kirtlandii*), a state (but not federal) listed endangered species, prefers open damp habitats, such as marsh edges, wet fields and pastures, creeks, canals, sluggish ponds and ditches (PDCNR. 2002). The latest documented occurrence of Kirtland's Snake in the general area of the site was in 1991 at a location along Keystone Ave. between 23rd and 35th Streets in the vicinity of the County Juvenile Center, approximately 2.4 miles south of the site (Hellmich, R. 2002). The site does not offer suitable habitat for this species and CVOC impacts are limited to subsurface site soils (almost entirely covered by the building and paved areas) and groundwater. Current site data does not support the potential for contact of this species with impacted subsurface soil on site. Although the extent of impacted groundwater has not been fully delineated, it is not likely that this terrestrial species, if present in the site vicinity, would have opportunity for ingestion of, or dermal contact with impacted groundwater.
- The Eastern Sand Darter (*Ammocrypta pellucidum*) is not a state or federally listed threatened or endangered species, but a "Species of Special Concern" in Indiana. The last documented occurrence of the Eastern Sand Darter in Fall Creek is an historical observation in 1942, at a location south of 36th Street, approximately 1.3 miles southeast (downstream) of the site on Fall Creek.
- No occurrences of endangered, threatened or rare freshwater mussels have been documented in Fall Creek south of Benjamin Harrison state park, approximately 5 miles northeast of the facility.
- Although there may be some potential for occurrence of the Indiana Bat (*Myotis sodalis*), a state and federally listed endangered species, along Fall Creek in the site vicinity, the Indiana Drainage Handbook (Appendix H.2, United States Fish and Wildlife Services (U.S. FWS) List of Indiana Streams and Habitats Associated with Endangered Species) does report Fall Creek as a stream with known occurrences of this species.

- If impacted groundwater did reach Fall Creek (approximately 380 feet southeast of the site), and no attenuation occurred across that distance, the concentrations of CVOCs present in the groundwater would be greatly diluted by Fall Creek, which has a reported daily mean flow of 392 cubic feet per second (USGS, 2002). Therefore, the possibility that impacted groundwater would have a significant effect on wildlife is effectively impracticable.

2.6 POTENTIALLY SUSCEPTIBLE AREAS

The site is located within a recently derived Wellhead Protection Area within Indianapolis. This designation is based on the site's proximity to Fall Creek, approximately 380 feet towards the south-southeast, and the IWC well field with wells as close as 1,600 feet southwest of the site and 1,200 feet northeast. The Fall Creek plant is currently operated by Veolia Water Indianapolis, LLC under IWC's supervision.

The IWC Fall Creek water plant collects groundwater from eight wells located within a radius of 1 mile. The older production wells (FC-2, FC-5, FC-7, FC-8, and FC-11) were installed prior to 1920 at depths approaching 400 feet and draw water from the bedrock, which is encountered between 80 and 100 feet bgs, underlying the lowest unconsolidated groundwater zone. The more recent wells (FC-17, FC-18, and FC-19 installed in 1988 and 1989) are screened within the deep sand and gravel unit immediately above the bedrock. Boring logs for the earlier wells are not available. IWC maintains boring logs of the more recent wells.

The IWC wells are pumped at fixed rates on an unscheduled basis dependent upon need. Operators maintain a rotation sheet, but have flexibility to select any well for pumping. Individual wells are occasionally pulled off-line for repair or maintenance, although IWC prefers not to do so during the summer. All documentation regarding pump operation is recorded chronologically on daily log sheets that are archived with IWC. There is no scheduled fluctuation of pumping rates or alternating pumping on a short term or seasonal basis.

The IWC reports that they have detected CVOCs in a number of wells scattered through the well field (upgradient as well as downgradient of Tuchman) but have not exceeded any drinking water standards. Recent groundwater analytical data (April 2004) from downgradient production well FC-17 identified only PCE at 0.00062 mg/L.

2.7 POSSIBLE CHEMICALS OF CONCERN

As stated above in Section 1.2, the known COCs within the soil and groundwater on site are PCE and its breakdown products TCE, cis-1,2-DCE, and vinyl chloride. Detections of trans-1,2-dichloroethene (trans-1,2-DCE), 1,1-dichloroethene (1,1-DCE), methylene chloride, benzene, toluene, and ethylbenzene have been reported but at concentrations that do not appear to be significant.

2.8 POTENTIAL CONTAMINANT TRANSPORT

The current impact present on site is confined to the subsurface soils and groundwater. Transport mechanisms such as surface water runoff, drainage ditch/storm sewer transport, or windblown particulate transport are considered unlikely because the primary source of impact appears to be spills that penetrated the interior floor. The dominant contaminant transport pathway appears to be via shallow groundwater flow in a west-southwest direction. However, impact to the intermediate and deep groundwater zones indicate some transport vertically downward through the layered glacial materials.

2.9 POTENTIAL HUMAN EXPOSURE PATHWAYS

The site is immediately bordered on all sides by commercial and retail areas. Residential areas are present within 300 feet of the site to the west. The primary potential pathways for exposure to humans are contact with impacted soil, contact/ingestion with impacted groundwater, and inhalation of vapors released from the soils and/or groundwater.

The potential for exposure to impacted soil is limited by the presence of buildings and pavement over virtually all of the area in which unsaturated soil is impacted. However, any excavation of soil within the impacted area of the facility should be regarded as a significant exposure potential.

Groundwater use represents a significant potential exposure pathway.

- The nearby IWC wells supply public drinking water for portions of Indianapolis. Pumping tests conducted for this phase of the RI demonstrate a hydraulic connection between the water supply wells and the deeper groundwater zones on site. No IWC wells have been found to be impacted above maximum contaminant levels (MCLs) to date so the pathway may not be complete, but is regarded as a significant potential.

- A production well is present on site near MW-6 at the northeast corner of the Tuchman facility. The well is used to supply water for wet-washing operations on site and historically was also connected to a faucet in a wash basin on site. The basin connection was removed from service in the late 1990s to prevent the potential for Tuchman staff to use it for potable purposes (the facility is supplied by city water for potable use). The onsite production well was installed by cable tool methods with a steel casing driven through the top of bedrock at 72 feet and terminating at 77 feet to allow an open hole in bedrock below to 145 feet. The well likely draws water from the fractured bedrock with significant potential for infiltration from the overlying sand and gravel unit (deep groundwater zone as discussed in Section 5.2.3).
- The IDEM canvassed the site vicinity for other groundwater users and found a single residential water well servicing 2035 E. 43rd Street. The property owner was contacted and samples were collected to evaluate the exposure potential.
- The potential exists for CVOCs in the soil and groundwater to volatilize into the soil gas and be released to the atmosphere. Testing inside the Tuchman facility indicates that the operations are in compliance with occupational safety standards but testing of potential off gassing of soil and/or groundwater impacts is impractical owing to the active use of PCE in the daily operations.

3.0 STATEMENT OF WORK

The RI-Phase II Work Plan dated August 19, 2003 outlined the objectives and approach of the aforementioned supplemental investigation, and provided the criteria for evaluating the data generated during the investigation. This section is included to summarize the objectives, activities conducted, and schedule of events accomplished during the investigation.

3.1 INVESTIGATION OBJECTIVES

The objective of the Phase II RI was to expand upon the findings of the RI Report dated April 4, 2003. The issues addressed during this second phase of investigation include: 1) delineation of offsite shallow groundwater impact identified downgradient of the facility, 2) evaluation of the nature and extent of CVOC impact identified in the intermediate monitoring well MW-4I, and 3) further characterization of the groundwater flow conditions of the intermediate and deep groundwater zones and evaluation of the hydraulic relationship between these units and the shallow aquifer. These objectives are instrumental in future design of a remediation system to ensure removal or destruction of mobile contaminants. A fourth objective was added to the investigation after the planning stage: further evaluate the extent of DNAPL impact under the western portion of the facility (interior source-area probes).

3.2 INVESTIGATION ACTIVITIES AND METHODS

The aforementioned objectives were addressed through two field efforts or stages: a Stage I effort designed to provide comprehensive groundwater data that further characterizes the extent of impact on- and off-site and an evaluation of the regional hydraulic conditions; and a Stage II effort where three intermediate monitoring wells were installed and groundwater quality conditions in three groundwater zones were tested.

3.2.1 Stage I Field Activities

The Phase II Stage I Field Activities, conducted between February 25 and April 8, 2004, included three separate field efforts conducted in sequence to allow the results of the earlier efforts to be incorporated into the approach of subsequent efforts. The first field effort, conducted between February 25 and 27, 2004, involved the advancement of seven off-site probes, three interior source-area probes, and one probe at the future location of deep piezometer PZ-10D. The second field effort included the installation of PZ-10D on March 18 and 19, 2004 and hydraulic flow monitoring and testing, which ran from March 18 through 22, 2004. The third field effort, conducted between April 6 and 8, 2004, involved the advancement of the remaining 10 off-site probes and groundwater sampling of a representative set of monitoring wells on- and off-site. A brief summary of the field activities is discussed below.

3.2.1.1 Off-Site Groundwater Assessment

The off-site probes OSP-1 through OSP-17 were advanced to delineate the extent of shallow groundwater impact downgradient of the facility, as illustrated in Figure 1. Borings were advanced to the top of the T-2 Till unit underlying the uppermost groundwater zone using a Geoprobe Model 66DT operated by Boart Longyear of Indianapolis, Indiana. To evaluate groundwater impact, one groundwater sample was collected from each probe for laboratory analysis. Seven probe locations immediately downgradient of the facility (OSP-1 through OSP-6 and OSP-13) were advanced during the first field effort to evaluate the extent of impact with potential to modify the remaining probe locations to provide optimum coverage of the further downgradient off-site area. The subsequent 10 probes were advanced at the planned locations except for OSP-10, which was moved from the western edge of 44th Street to the western sidewalk of North Keystone Avenue, in line with monitoring well MW-11 and off-site probe OSP-13.

During all probe advancement, soil samples were screened for VOCs [including solvent-related compounds] in the field using a photoionization detector (PID), divided into 2-foot intervals, and placed in sealable plastic bags for subsequent headspace measurements. Soil samples were visually classified in the field according to the descriptive terminology of the Unified Soil Classification System (USCS) presented in American Standard Test Method (ASTM) D-2488. Soil samples were examined for DNAPLs under an ultraviolet (UV) light, as described by Cohen

et al. (1992) where headspace screening yielded elevated PID reading (greater than 1,000 ppm) suggesting a potential for the presence of DNAPLs. As a confirmation to the field observations and measurements, three soil samples were selected for laboratory analysis based on initial PID measurements or visual evidence of contamination as determined by the field team.

3.2.1.2 Deep Piezometer Pre-Analysis and Installation

The intermediate probe Pre-PZ-10D was advanced on February 27, 2004 at the planned location of the deep piezometer PZ-10D (Figure 1) to evaluate the shallow and intermediate groundwater quality prior to installing the deep piezometer through these intervening zones. Groundwater samples were collected from both zones for laboratory analysis.

Deep piezometer PZ-10D was installed on March 18 and 19, 2004 to 68.75 feet by American Drilling Service (ADS) of Indianapolis, Indiana (Indiana Certified Driller License #293) using an all-terrain vehicle (ATV) mounted CME-750 rig with 4.25 inner diameter (ID) hollow stem augers. Based on the groundwater analytical results from Pre-PZ-10D, no surface casing was installed. The piezometer was constructed of 2-inch Schedule 40 polyvinyl chloride (PVC) with a 10-foot, 0.010-inch slotted screen between 58.75 and 68.75 feet bgs.

3.2.1.3 Hydraulic Testing

Hydraulic testing was conducted between March 18 and 22, 2004 with the objective of monitoring groundwater level response to local and regional pumping activities, both known and unknown. Selected wells screened within the shallow, intermediate, and deep groundwater zones were monitored using programmable data loggers with downhole pressure transducers or by manual measurements with an electronic well probe.

Set-up for the hydraulic testing included the placement of In-Situ MiniTROLL water level data loggers in wells MW-4, MW-4I, MW-4D, MW-6I, MW-6D, and MW-13I for 1-minute measurements from March 18 through 22, 2004. Two pressure transducers attached to In-Situ Hermit 1000C data loggers were also placed in selected wells during pumping tests on March 21 and 22, 2004 to provide additional hydraulic response data.

The measurements collected between March 18 and early March 21 (before 9:00 AM) represent ambient groundwater conditions. Influences on ambient conditions include cyclic pumping from the Tuchman production well on Thursday, Friday, and Saturday during business hours and pumping of IWC production wells FC-2, FC-8, FC-11, FC-18, and FC-19 (except that FC-11 was turned off at noon on Friday, March 19, 2004 as discussed below).

Aquifer response to FC-11 operation was tested by stopping the well at noon on March 19 (after several months of operation), then running it again from 9:00 AM to 11:20 AM on March 21 and again from 3:40 PM on March 21 to 7:00 AM on March 22. Water level data collection continued until 7:00 PM on March 22 in order to monitor aquifer recovery.

During the recovery period for FC-11, the aquifer response was further tested by operation of the Tuchman bedrock production well. The well operates normally in response to the facility's daily water use for wet cleaning laundry. This use is typically greatest during the morning shift where pumping would turn on and off at an approximate frequency of 12 cycles per hour. To test the hydraulic response of a maximum pumping frequency, the well use was artificially elevated and sustained by opening multiple faucets within the facility between 3:42 PM and 5:51 PM on March 22. The well did not operate continuously during this time, but rather cycled on and off approximately 20 times per hour in rapid succession to maintain the necessary pressure within the water lines as water was drained through the faucets.

Hydraulic response to RW-1 operation was tested on March 22. After having been inactive for approximately 3 days, RW-1 was run at approximately 9.5 gpm between 12:15 PM and 2:18 PM.

IWC production well FC-17 was not tested because the pump was inoperable at the time of the hydraulic testing. RW-3 was also not tested because of the presence of DNAPL in the well.

3.2.1.4 Interior Source Area Borings

As a supplement to the scope of the RI-Phase II WP, three source area probes (IB-1 through IB-3) were advanced within the Tuchman facility in the vicinity east, north, and northeast of recovery well RW-3 (Figure 2). The probes were advanced to test for a deeper "Top of Till" surface between previously advanced Geoprobe borings (RW-3, GP-15, GP-17, GP-1, and GP-13) in an effort to identify the presence or absence of DNAPL beyond the confirmed presence at RW-3. One groundwater sample was collected from the base of each temporary piezometer for laboratory analysis.

Soil samples were screened for VOCs [including solvent-related compounds] in the field using a PID and divided into 2-foot intervals and placed in sealable plastic bags for subsequent headspace measurements. Soil samples were examined for DNAPLs under an UV light, as described by Cohen et al. (1992).

3.2.1.5 Monitoring Well Sampling

Groundwater samples were collected between April 6 and 8, 2004 from a representative set of the existing monitoring wells (MW-3, MW-4, MW-4I, MW-4D, MW-5, MW-6, MW-6I, MW-6D, MW-7, MW-11, MW-13, MW-13I, MW-14, MW-14I, MW-15, MW-16, and RW-1) to supplement the analytical results collected from the off-site probes. These samples were collected using disposable polyethylene (PE) bailers and were submitted for laboratory analysis.

The groundwater sampling event involved an initial groundwater piezometric/potentiometric survey of all wells, piezometers, and off-site probe piezometers prior to groundwater sampling. Depth-to-water measurements were collected from each point, using an electronic water level indicator. These readings were recorded and used to establish groundwater elevations in order to characterize groundwater flow direction and gradient across the site.

Three well volumes of water were purged from each well using disposable PE bailers. During purging, the discharge water was tested for field parameters (pH, temperature, and specific conductance) using a combination meter. Well purging continued until each of the measured field parameters fell within 10 percent of values from the prior purge volume. After the well was purged of a minimum of three well volumes, and the field parameters listed above had stabilized, a groundwater sample was collected by bailer.

Samples collected for VOCs analysis were transferred directly from the bailer into three 40-milliliter glass vials preserved with hydrochloric acid (HCl) and a plastic cap with a Teflon® septum to exclude trapped air.

In addition to the VOC analysis, indicator parameters included the standard field parameter measurements of temperature, specific conductance, and pH, plus the addition of dissolved oxygen, oxidation-reduction potential (ORP).

All generated purge water was added to the remediation system.

3.2.1.6 Analytical Testing

All selected samples were stored in ice-chilled coolers at approximately 4 degrees Celsius (°C) and transported under chain-of-custody procedures to Severn Trent Laboratories (STL) of North Canton, Ohio via overnight courier. The samples were analyzed for VOCs using U.S. Environmental Protection Agency (U.S. EPA) SW-846 Method 8260B, as described in the U.S. EPA publication, Test Methods for Evaluation of Solid Wastes, Physical/Chemical Methods (SW-846, 3rd Edition, Update 2). These samples were analyzed within the required 14-day holding time for the VOC analysis. The analytical results were reported in a "RISC Level 4" data package, in accordance with the Quality Assurance Project Plan (QAPP).

3.2.2 Stage II Field Activities

The Stage II field activities were conducted between August 16 and September 14, 2004 with groundwater levels of intermediate and deep monitoring wells collected on November 11, 2004. Details of the monitoring well installation, groundwater sampling, and groundwater flow evaluation activities are discussed below.

3.2.2.1 Intermediate Monitoring Well Installation

The interior intermediate piezometer was installed between August 16 and 18, 2004 by ADS of Indianapolis, Indiana (Indiana Certified Driller License #293) using a Geoprobe Model 66DT. The exterior intermediate monitoring wells (MW-2I and MW-3I) were installed at locations illustrated on Figure 2 on September 8 and 9, 2004 by Boart Longyear of Indianapolis, Indiana (Indiana Certified Driller License #2019) using roto-sonic drilling methods.

The Stage II monitoring wells were advanced at least 1 foot past the base of the target zone and set within the upper 1 foot of the underlying till to allow for collection of DNAPLs, if present. The monitoring wells were installed between 42 and 49.5 feet bgs and were isolated from the uppermost groundwater zone through the installation of a temporary steel surface casing seated within the T-2 till unit underlying the shallow aquifer. The surface casing was retracted during the monitoring well installation process only after the lower aquifer was adequately sealed from the open borehole with hydrated bentonite and cement/bentonite grout.

Continuous soil samples were collected from each boring and split into 2-foot intervals for similar tests as those described for the Stage I activities in order to characterize the subsurface conditions.

The exterior intermediate monitoring wells were constructed of 2-inch ID PVC well casing equipped with a 5-foot long, 0.010-inch slot, 2-inch ID PVC screen. Intermediate well MW-1I was constructed of 1-inch ID PVC well casing equipped with a 5-foot long, 0.010-inch slot, 1-inch ID PVC screen because of the physical limitations of its interior location.

A filter pack consisting of Global #5-sized silica sand was placed into the annular space around the screen and extended a minimum of 2 feet above the top of each well screen. A minimum 3-foot thick bentonite seal was placed above the filter pack at each well using bentonite chips hydrated with potable water. The remaining annular space around the wells was grouted to near surface (2 feet bgs) with a cement/bentonite grout. The monitoring wells were completed with flush mounted steel-guard covers set within the surrounding concrete floor or asphalt surface. Each monitoring well was secured with a lockable cap and padlock.

Monitoring wells MW-1I, MW-2I, and MW-3I were developed after installation to ensure proper hydraulic connection between the monitoring well and the intermediate groundwater zone. The wells were developed by purging of at least five well volumes using disposable PE bailers (MW-1I) or a submersible pump (MW-2I and MW-3I). The submersible pump was decontaminated in accordance with procedures outlined in the IWP before insertion into each well.

Soil cuttings generated during the field activities were contained in labeled, 55-gallon drums temporarily stored at the site. The drums were transported by Kemark Environmental Services, Inc. (Kemark) of Fort Wayne, Indiana and disposed at the EQ facility in Belleville, Michigan. Drill flushing water and development water was treated through the onsite air-stripper unit and discharged off site within the limits of the permitted discharge to the sanitary sewer.

3.2.2.2 Groundwater Sampling

Groundwater samples were collected from the newly installed intermediate monitoring wells (MW-1I, MW-2I, MW-3I) and a representative set of shallow monitoring wells (MW-1, MW-3, MW-4, MW-4I, MW-4D, MW-5, MW-6, MW-6I, MW-6D, MW-7, MW-10, MW-11, MW-12, MW-13, MW-13I, MW-14I, MW-15, MW-16, and RW-1) on September 13 and 14, 2004. The procedures for sampling are summarized below with detailed procedures discussed in the QAPP.

The groundwater sampling event involved an initial groundwater piezometric/potentiometric survey of all wells, piezometers, and off-site probe piezometers prior to groundwater sampling. Depth-to-water measurements were collected from each monitoring well, using an electronic water level indicator. These readings were recorded and used to establish groundwater elevations in order to characterize groundwater flow direction and gradient across the site. At selected wells and interior piezometers, the presence or absence of DNAPL was tested by lowering a Solinst Model 122 Oil/Water Interface probe through the groundwater column.

A minimum of three well volumes of water were purged from each well using disposable PE bailers. During purging, the discharge water was tested for field parameters (pH, temperature, and specific conductance) using a combination meter. Well purging continued until each of the measured field parameters fell within 10 percent of values from the prior purge volume. After the well was purged, a groundwater sample was collected by bailer.

Samples collected for VOCs analysis were transferred directly from the bailer into three 40-milliliter glass vials preserved with HCl and a plastic cap with a Teflon® septum to exclude trapped air.

Collected groundwater samples were immediately transferred and stored in coolers chilled with ice to maintain temperature at approximately 4°C. The samples were shipped to STL via overnight courier under chain-of-custody protocol for analysis of VOCs using SW-846 Method 8260B. The analytical results were reported in a "RISC Level 4" data package, in accordance with the QAPP.

In addition to the VOC analysis, indicator parameters included the standard field parameter measurements of temperature, specific conductance, and pH, plus the addition of dissolved oxygen, ORP.

All generated purge water was treated by the air stripper unit and then discharged off site via the sanitary sewer.

3.2.2.3 Interior Source Area Borings

Four more source area probes (IB-4 through IB-7) were advanced within the Tuchman facility within a closer vicinity west, north, and northeast of recovery well RW-3 (Figure 2). The probes were advanced to test for a deeper "Top of Till" surface in an effort to identify the presence or

absence of DNAPL beyond the confirmed presence at RW-3. One groundwater sample was collected from the base of each temporary piezometer for laboratory analysis.

During all probe advancement, soil samples were screened for VOCs [including solvent-related compounds] in the field using a PID and divided into 2-foot intervals and placed in sealable plastic bags for subsequent headspace measurements. Soil samples were examined for DNAPLs under an UV light, as described by Cohen et al. (1992) where headspace screening yielded elevated PID reading (greater than 1,000 ppm) suggesting a potential for the presence of DNAPLs.

3.3 INVESTIGATION SCHEDULE

The field schedule for the RI-Phase II Work Plan (dated August 19, 2003) was initiated after receiving an approval letter from IDEM for the field activities on January 15, 2004.

The Stage I field activities were conducted between February 25 and April 8, 2004. In accordance with the RI-Phase II Work Plan, Tuchman submitted an Interim Summary Report on June 9, 2004 that summarized the Stage I field activities and presented the data generated during that investigation.

The Stage II monitoring well installation activities were conducted between August 16 and September 14, 2004. In order to provide groundwater flow direction when IWC production well FC-11 was not operating, an additional groundwater level measurement event for the intermediate and deep wells was conducted on November 11, 2004.

4.0 PROJECT INVESTIGATION METHODS

The field activities were conducted in general accordance with the RI-Phase II Work Plan, the IWP, and the enclosed QAPP (presented in Appendix C of the IWP). Description of the project investigation methods and variances from the RI-Phase II Work Plan, IWP, and QAPP are discussed each staged field activity section in Section 3.

5.0 INVESTIGATION RESULTS

The field measurements and results of sample analyses for the Stage I and Stage II field activities are discussed in this section. As noted in the RI-Phase II Work Plan, the objectives of the field activities are to: 1) delineate offsite shallow groundwater impact identified downgradient of the facility, 2) define the nature and extent of CVOC impact identified in the intermediate monitoring well MW-4I, 3) provide further characterization of the groundwater flow conditions of the intermediate and deep groundwater zones and to evaluate the hydraulic relationship between these units and the shallow aquifer, and 4) further evaluate the extent of DNAPL impact. In adherence with the QAPP, the investigation used field observations and measurements, and the results of laboratory testing of soil and groundwater samples to evaluate the aforementioned objectives.

The discussion of investigation results presented below is organized into the following sections: Subsurface Geology, Hydrogeology, Nature and Extent of Soil Impact, Nature and Extent of Groundwater Impact.

5.1 SUBSURFACE GEOLOGY

During this second phase of investigation, an additional 13 soil borings, 13 piezometers, and three wells were advanced onsite or in the general vicinity of the site. Soil samples were collected continuously from all borings, examined by a geologist, and classified using the criteria of the USCS as outlined in ASTM standard D2488. Field measurements and soil classifications of each boring advanced during the Stage I and II activities are presented on the logs in Appendix A of this report.

The data collected during the RI-Phase II were used to update the subsurface geologic conditions discussed in the RI Report. The updated data are best summarized on cross section A-A' illustrated on Figure 3 and cross section B-B' on Figure 4. Cross section A-A' depicts conditions along a line running east-west through the site from MW-6 in the east to MW-14 to the west as mapped on Figure 2. These cross sections continue to illustrate carbonate bedrock overlain by approximately 70 feet of unconsolidated material consisting of several units ranging from fine-grained to coarse. The following eight unconsolidated material units were identified during the Phase I RI and used for discussion in this report:

- Fill material;
- Near surface clay-rich ablation till sediments;
- Sand and gravel derived from recent glacial outwash (Shallow Groundwater Zone);
- An upper Wisconsin-aged glacial till (Aquitard/Aquiclude);
- A thin, interbedded sand and gravel layer within glacial till (Intermediate Groundwater Zone);
- A lower Wisconsin-aged glacial till unit (Aquitard/Aquiclude);
- Pre-Wisconsin sand and gravel deposits associated with glacial outwash fans and meltwater channels (Lower Groundwater Zone);
- Pre-glacial, clay-rich residuum overlying Devonian-aged limestone.

The borings advanced during the RI Phase II investigation confirm the presence and character of these units regionally, with subtle changes observed within the units, as discussed below, starting with the uppermost.

5.1.1 Fill Material

The RI Phase I investigation identified the fill material as a significant unit that potentially influences the infiltration of groundwater and the migration of contaminants. The data collected during the RI Phase I and this investigation (RI-Phase II) indicate the presence of 0 to 8 feet of sandy and gravelly fill materials below concrete or asphalt pavement across the site. These materials are reworked native soil or imported fill material presumably used to level the site for construction of the building or pavement areas. At a few locations observed during the Phase I RI, there were old pavement surfaces buried within the fill zone that may significantly influence the infiltration of groundwater and the potential migration of contaminants.

5.1.2 Upper Clay Unit (T-3)

The next unit under most of the site is a clay-rich material generally 3 to 10 feet thick, referred to here as the Upper Clay Unit. The material is generally moist to dry and is moderately stiff. This unit is expected to behave as an aquitard, slowing the infiltration of groundwater to the underlying aquifer zones except where absent or having significant secondary porosity (fractures). The Upper Clay Unit was likely deposited as an ablation till during the retreat of the last glacial episode and therefore is not as hard and compact as deeper till units on site.

The off-site borings indicate that the upper clay unit tends to thin out (0 to 4 feet thick) west of North Keystone Avenue at borings OSP-1, OSP-2, OSP-4, OSP-5, OSP-6, OSP-8, OSP-9, OSP-11, and OSP-13.

5.1.3 Shallow Groundwater Zone

The shallow groundwater zone on site consists of 8 to 18 feet of sand and gravel material that is usually first encountered within the upper 10 feet. The sediments are generally well graded and loose, but layers of well-sorted, finer sand are present within the unit. The upper portion of the sand and gravel is usually slightly moist with the zone of saturation starting at approximately 12 feet bgs (further discussion in Section 5.2).

Off site, the shallow groundwater zone tends to range from 7 to 33 feet thick. These deposits are thickest towards the northwest (OSP-13) and southwest (OSP-1, OSP-4, OSP-5, OSP-6, OSP-8, OSP-9, OSP-11) and are encountered nearer to the surface along the southern limit of the investigation (probes OSP-6, OSP-9).

These sediments were likely deposited within interglacial meltwater channels or outwash fans during the late Wisconsin glacial stage. The environment would likely have ranged from low-flowing streams that deposited fine to medium sand to high-energy flooding waters that transported coarse gravel, cobbles, or larger materials. This variability was observed both vertically within individual borings and laterally between boring locations. The higher energy areas of the environment would have caused localized erosion and scouring within the streambed and underlying glacial till.

5.1.4 Upper Till Unit (T-2)

The Upper Till (T-2) is well-graded silty clay with some sand gravel material that is generally 15 to 21 feet thick, with MW-9D reporting an 8-foot thickness. Data collected during the RI-Phase II investigation supports the notion that this till is a hard, over-consolidated material whose samples demonstrated little to no moisture. The Phase I RI report suggested that this assemblage was deposited at the base of a glacier where the weight of the overlying ice caused over-compaction of the sediments.

The Phase I RI report indicated that this unit likely behaves as an aquitard (versus a complete aquiclude), with possible infiltration of groundwater to the underlying aquifer zones in locations where the till unit may be absent or secondary porosity (microfractures) is present. However, monitoring of shallow, intermediate, and deep wells during the start up and stopping of regional and local pumping activities identified that the hydraulic response of the shallow groundwater zone is independent of the intermediate and deep groundwater zones, thus suggesting that any hydraulic connection through this unit is indirect at best.

The depth measurements to the top of till from the 28 borings, piezometers, and wells advanced during the RI-Phase II investigation were used to update the upper till unit (T-2) surface maps, as illustrated regionally on Figure 5 and locally on Figure 6.

The regional map (Figure 5) illustrates a till surface ridge that extends from OSP-15 northwest towards MW-13I and bends west towards OSP-1 and OSP-4. From the ridge in the vicinity west of MW-13, the till surface appears to slope southwest towards OSP-6, west-southwest towards OSP-11, and north-northeast towards OSP-10 and OSP-13. The northern edge of the Tuchman building is underlain by a rise/ridge within the till surface, but the surface slopes northward towards PZ-10D.

Within the northwestern portion of the Tuchman site (Figure 6), the local map illustrates a depression within the till surface that is oriented towards the northwest and likely represents a former meltwater channel or scour mark. The interior source area borings have provided significant control of the 704 feet mean sea level (msl) and 703 feet msl contour lines in the vicinity of RW-3. The data indicate a localized depression in the till surface at RW-3. The top of till surface is lower at IB-1, IB-2, and IB-3, but field measurements and groundwater analytical results clearly indicate that DNAPL was unable to migrate to these locations.

5.1.5 Intermediate Groundwater Zone

The Phase I RI report described the intermediate groundwater zone as a sand and gravel zone generally less than 4 feet thick, intercalated within the massive glacial till. Additional data collected from the installation of intermediate and deep wells indicate that the character of the intermediate groundwater zone varies from a 4 to 5-foot thick gravel/sand and gravel unit towards the north (MW-2I, PZ-10D, MW-6D) to multiple 1-foot layers of gravelly silt, sand and gravel, or gravel in the central portion of the facility (MW-4I, MW-1I, MW-13I), to a single sand and gravel unit (1 to 3-foot thick) towards the southwestern portion of the facility (MW-4D, MW-3I, MW-14I). This lack of continuity within the unit is also observed when evaluating the groundwater potentiometric surface among the intermediate wells, as illustrated on Figure 11. Further discussion of the hydraulic character of the intermediate groundwater zone and its hydraulic relationship among the intermediate wells is discussed in Section 5.2.

This sand and gravel zone was likely deposited by similar interglacial processes as those described above for the shallow aquifer. The layers observed in the monitoring wells suggest high-energy flooding waters that transported fine-to-coarse sand and gravel. As such, the meltwater channels and/or outwash deposits most likely also impacted the underlying glacial till surface through erosion, thus creating an uneven base for this aquifer. The sand and gravel deposits at this depth were likely greater prior to the advance of the glacier producing the overlying Till Unit T-2. It is likely that several glacial advances occurred during the timeframe when the intermediate groundwater zone was deposited, producing the interbedded till and sand units that are observed at MW-4I, MW-1I, and MW-13I. The onset of each glacial advance likely caused truncation of sediments across most of the site and redistributed the sand and gravel elsewhere, including in the vicinity of MW-9D. Taking into account the possible depositional environment, it is believed that the anomalously high sand and gravel zone at MW-9D is linked to the intermediate groundwater zone at other wells, despite the elevation difference.

5.1.6 Lower Till Unit (T-1)

The Lower Till (T-1) unit onsite consists of 11 to 14 feet of predominantly silty clay material extending to approximately 55 feet bgs at MW-4D and MW-6D and to 60 feet bgs at PZ-10D. As discussed in the Phase I RI report, this material is well graded with fine-grained (silt and clay) and coarse-grained (sand and gravel) soils that are over-consolidated by the weight of the

advancing glacial during deposition. As such, these sediments are hard and generally dry. The lower few feet of this unit contains a greater percentage of sand.

The Phase I RI report identified this unit as an aquitard that separates the intermediate and the deep groundwater zones.

5.1.7 Deep Groundwater Zone

The data collected from the newly installed deep piezometer PZ-10D generally supports the original Deep Groundwater Zone description as being a well-graded sand material with gravel, although the thickness of the unit at PZ-10D is only 7.5 feet thick, compared to the 11 to 17.5-foot thickness observed elsewhere. This unit is generally dense and fully saturated. An updated discussion of this aquifer is provided in Section 5.2.

The Phase I RI report identified these sediments as being pre-Wisconsin meltwater channel or outwash deposits at a time when glacial presence was close. All deep wells and piezometers present on site identify coarser sand and gravel at the base of the unit (high energy, braided stream environment), overlain by more sorted silty sand with occasional gravel (stream water channel). It is likely that a portion of this better sorted unit was truncated by the overlying Lower Till Unit (T-1).

5.1.8 Pre-glacial Residuum

Pre-glacial Residuum unit consists of 2 to 4 feet of "terra rosa" clay residuum that is characteristic of a weathered carbonate bedrock horizon. This material is considered a pre-glacial paleosol that is very stiff and moist to dry.

5.1.9 Devonian-Aged Bedrock

Devonian-aged carbonate rocks were encountered in borings MW-6D and MW-4D at approximately 71 to 72 feet bgs, respectively. Deep Piezometer PZ-10D encountered auger refusal on this bedrock at 68.75 feet bgs. This rock unit is predominantly dolostone.

5.2 HYDROGEOLOGY

As summarized in the Phase I RI report, two water-bearing zones and a third, less significant zone were identified on site. This section of the report discusses the results of the hydraulic testing conducted during the Stage I field activities and the resulting understanding of the hydrogeologic character of these three units including the direction and gradient of groundwater flow.

Groundwater elevation data collected during this investigation consisted of the water level measurements from up to 20 shallow wells or piezometers, seven intermediate wells, one deep piezometer, and two deep monitoring wells. The groundwater measurements listed on Table 3 include the February 19, 2003 sampling event (Phase I RI investigation) and four subsequent groundwater level measurement events performed between March 19, 2004 and November 11, 2004. The piezometric map of the shallow groundwater zone based on the April 6, 2004 Stage I groundwater sampling event (including groundwater elevations from the off-site probe piezometers) is presented on Figure 7. The potentiometric map of the intermediate groundwater zone based on measurements during the Stage II groundwater sampling event conducted on September 13 and 14, 2004 is presented in Figure 8.

5.2.1 Hydraulic Testing Results

The groundwater elevation data collected during the hydraulic monitoring is presented in Figure 9. The figure includes the groundwater level measurements collected from wells MW-4, MW-4I, MW-4D, MW-6I, MW-6D, and MW-13I using the MiniTROLLs and the March 21, 2004 groundwater measurements from wells MW-14I and PZ-10D using pressure transducers attached to Hermit 1000C data loggers. Bar graphs illustrating the timing of FC-11 operations and the timing of the RW-1 and Tuchman production well pumping tests are presented at the top of the chart.

At the outset of data collection, FC-11 had been in generally continuous operation at approximately 695 gpm (1 million gpd) for 93 days (since December 15, 2003). Under this condition, the intermediate zone potentiometric surface graded from east (MW-6I) to west (MW-13I, MW-14I), as did the deep groundwater zone (MW-6D to MW-4D); deep piezometer PZ-10D was not being monitored during this period. Conditions in the deep zone appear relatively static compared to the intermediate where MW-14I and MW-6I experienced an early disturbance

and MW-6I systematically declined more than 1 foot between March 18 and 19. The early disturbance coincides with a rainfall event, but the systematic decline in MW-6I does not correlate to any of the monitored input parameters.

When FC-11 was turned off on March 19 at 12:00 noon, water level rebounded close to 6 feet in both the intermediate zone and the deep zone. Start up and shut down of FC-11 on March 21 and 22 showed a similar hydraulic response to that observed on March 19. The data indicate that when FC-11 is not running, MW-6I becomes the downgradient well, suggesting a lesser degree of connection to the bedrock aquifer pumped by FC-11. Wells MW-13I and MW-14I demonstrated the greatest response within the first 10 minutes of pump operation with MW-6I responding least to the pumping conditions, suggesting that the connection between the bedrock aquifer and the intermediate zone is either west of the site, or that the water-bearing unit at MW-13I and MW-14I is better connected to the lower groundwater zones.

In the deep zone, the hydraulic gradient between MW-4D and MW-6D become negligible, but both wells on March 21 and 22, 2004 appear to demonstrate greater response to FC-11 pumping than PZ-10D, suggesting better connection to the bedrock aquifer.

There was no observed connection between the bedrock aquifer pumped by FC-11 and the shallow groundwater zone. Conversely, the pumping of RW-1 in the shallow zone had no measurable impact on either the deep or intermediate zones.

Groundwater level response from the RW-1 pump test, as listed in Table 4, identifies an observed drawdown of 0.05 feet or greater in shallow monitoring wells MW-9, MW-5, MW-1, MW-8, MW-7, MW-3, and MW-11. These measurements indicate a 0.05-foot drawdown radius of 60 to 70 feet from RW-1.

Review of IWC's pumping records indicates that within the past year and a half (March 26, 2003 through November 11, 2004 minus the time between March 30 and June 1, 2004), FC-11 was pumped for approximately 385 days out of 532 days recorded. Consequently, the hydraulic influence attributable to FC-11 was present for approximately 72 percent of the time within the past year and a half.

Pumping of the Tuchman production well during normal facility operations on March 18 and 19, 2004 and during the planned testing on March 22, 2004 had a relatively small impact on the

intermediate and deep groundwater zones. This can be seen in the small drawdown signatures in monitoring wells MW-4I, MW-13I, MW-4D, and MW-6D on March 19, 20, and 22. The lack of signature or very subtle signature in MW-6I further suggests a poor or indirect connection with the pumped bedrock zone and select locations within the intermediate groundwater zone. Tuchman's production well apparently does not significantly influence the direction of groundwater flow in either the deep or intermediate groundwater zones.

5.2.2 Shallow Groundwater Zone

The shallow groundwater zone exists within the upper sand and gravel unit as described in Section 5.1.3 above. The shallow groundwater zone is monitored through 16 monitoring wells (two wells off site), two recovery wells, and four off-site probe piezometers, which provide the hydrogeologic information collected for this investigation.

Depth to water in the Shallow Groundwater Zone onsite ranges between 9 to 13 feet bgs with groundwater elevations ranging between 716.1 and 718.4 feet, msl, as presented in Table 3. The depth to water from the off-site probe piezometers range from 11.8 to 23.5 feet bgs with groundwater elevations dropping off to 714.1 feet (msl). As illustrated in Figures 3 and 4, these groundwater levels are within the permeable sand and gravel unit, allowing the water bearing zone to behave as an unconfined aquifer. Seasonal variations over the past year and a half have caused minimal fluctuations, as shown by the relatively consistent groundwater elevations listed above. Under ambient conditions, groundwater flows in a west-southwesterly direction at an approximate gradient of 0.002 feet/feet, as presented in the RI Phase I Report. Across the site, groundwater elevations generally vary less than 0.6 feet, with monitoring wells MW-13 and MW-14 measuring approximately 1 foot lower than upgradient well MW-6.

Pumping tests of the shallow aquifer conducted by URS in 1995 (Dames & Moore, 1996) generated data suggesting the hydraulic conductivity to be on the order of 4.0×10^{-4} cm/second with a storage coefficient of 0.01 (semi-confined conditions). Based on the hydraulic conductivity and gradient mentioned and a porosity of 0.352, the calculated groundwater velocity of the shallow groundwater is a relatively low 0.0064 feet/day.

During the operation of recovery well RW-1, the piezometric surface of the shallow groundwater continues to flow westerly, but reflects a hydraulic pull towards RW-1 on the western portion of the facility, as illustrated in Figure 9. The zone of groundwater capture induced by pumping of

RW-1 covers an area approximately 80 feet wide extending to the east and encompassing more than half of the facility operations, with a 0.05-foot drawdown observed approximately 70 feet from RW-1. Groundwater flow west of the facility tends to be southwest.

5.2.3 Intermediate Groundwater Zone

The intermediate groundwater zone is first encountered between 32 and 42 feet below grade and comprises either a single 1.5 to 4 foot thick sand and gravel unit or a series of individual 1-foot layers, as described in Section 5.1.5 above. Seven monitoring wells currently monitor this aquifer: MW-6I that was installed in 1995, wells MW-4I (on site) and offsite wells MW-13I and MW-14I that were installed in 2003 and MW-1I, MW-2I and MW-3I that were installed during the Stage II activities.

Slug tests conducted on intermediate wells MW-9I [formerly MW-9D(A)] and MW-6I derived hydraulic conductivity values of 1.7×10^{-4} and 5.1×10^{-4} cm/second, respectively. Transmissivity values were calculated to be approximately 4.8 feet²/day.

Groundwater levels range between 10 and 20 feet bgs, depending on whether the IWC production well FC-11 is pumping. All recorded measurements are significantly above the top of the zone, indicating confined aquifer conditions. Groundwater levels in the intermediate zone are generally lower than those in the upper zone, indicating a downward hydraulic gradient between the two zones.

The groundwater flow direction during the September 13, 2004 groundwater sampling event was towards the west with two nearly level gradients of 0.0014 feet/feet west of MW-4I and 0.0018 feet/feet east of MW-1I, separated by a hydraulic barrier illustrated with a gradient of 0.349 feet/feet (Figure 9). Using the aforementioned hydraulic conductivity, the gradient of the nearly level area, and assuming porosity to be 0.35, the groundwater velocity in this aquifer is likely to be between 0.0011 and 0.0033 feet/day.

The results of the hydraulic testing limited the potential hydraulic influences on the intermediate groundwater zone to the IWC production well FC-11. The hydraulic data do not support RW-1, Tuchman's onsite production well, or Fall Creek as a root cause of drawdown observed in groundwater elevation measurements.

5.2.4 Deep Groundwater Zone

The deep groundwater zone occurs in the 8 to 14.5 foot thick sand and gravel unit described in Section 5.1.5 above. With the addition of deep piezometer PZ-10D to the existing deep wells MW-4D and MW-6D, greater certainty can be applied to interpretation of the groundwater flow direction and gradient. In addition to groundwater elevations listed in Table 3, an illustration of the potentiometric surface of the deep groundwater zone under static and IWC well FC-11 pumping conditions are presented on Figure 10.

Depth to water measurements collected in February 2003 range from 17.4 to 17.74 feet bgs, indicating hydraulically confined groundwater conditions (Table 3). These measurements translate in groundwater elevations of 710.16 and 710.46 feet, msl, which are lower than both the shallow and intermediate groundwater zones.

With the addition of deep piezometer PZ-10D to the existing deep wells MW-4D and MW-6D, the general direction of groundwater flow was calculated to be northwest under static conditions (November 11, 2004 measurements) at an approximate gradient of 0.00088 feet/feet. However, groundwater level measurements collected on September 13, 2004 (Stage II groundwater sampling event) indicate that the deep groundwater flows southeast at an approximate gradient of 0.02089 feet/feet when IWC well FC-11 is operating.

5.3 NATURE AND EXTENT OF SOIL IMPACT

All soil samples collected through Stage I and Stage II activities were screened in the field to qualitatively evaluate the potential for impact. However, analytical testing of soil samples was limited because the objective of this phase of investigation was to evaluate groundwater hydraulic behavior and to further delineate groundwater impact observed in the earlier phase investigation. Impact observed in off-site probes was not expected to be derived from surface impact, but rather groundwater migration. Likewise, the deep and intermediate piezometers and wells were located outside of the known impact area.

Four soil samples were submitted for analysis: three samples from off-site probes and a sample from a stained sand unit in the deep piezometer.

The following sections describe the findings of both field screening and laboratory analyses of soil samples as they pertain to the nature and extent of impact. Field screening results are presented on the logs for each boring and monitoring well advanced during this investigation, included in Appendix A. The data from laboratory analysis of the select samples are summarized on Table 5 with the full laboratory reports presented in Appendix D.

5.3.1 Shallow Probes and Piezometers

Continuous soil sampling was performed during the advancement of off-site probes (OSP-1 through OSP-17) and the installation of the interior source area borings (IB-1 through IB-7). Positive screening PID responses from the off-site probes were limited to five measurements within the saturated shallow groundwater unit at concentrations less than 4.3 ppm above background. Significant positive PID screening responses (greater than 5 ppm) were observed in the following three borings within the shallow groundwater unit above the water table: IB-1 (up to 25.6 ppm between 8 and 14 feet, bgs), IB-2 (7.1 ppm at 11 to 12 feet bgs), and MW-1I. (1 ppm and 67.1 ppm measured at 8-9 and 9-10 feet, respectively). Elevated screening PID responses (greater than 100 ppm) were observed at the base of the shallow groundwater unit at IB-2 (>1,000 ppm), IB-5 (>2,000 ppm), IB-6 (>2,000 ppm), IB-7 (>2,000 ppm), MW-1I (177 ppm), and MW-2I (1,160 ppm).

Headspace PID measurements tended to mimic the screening PID responses except during the advancement of off-site probes OSP-7 to OSP-12 and OSP-14 to OSP-17. Positive PID headspace measurements were recorded with two measurements: an initial response when the probe was inserted into the bag containing the headspace, and a second delayed PID response that was slow to respond and slow reset when the probe was removed. The second readings are generally attributed to moisture in the bag and are not considered significant.

Three soil samples from the off-site probes were selected for laboratory analysis: OSP-11 from 0-2 feet and OSP-16 from 2-4 feet to verify the presence or absence of delayed PID headspace measurements of >2,000 ppm and 91.7 ppm, respectively; and OSP-14 from 14 to 16 feet where black stained sand was encountered. Soil sample OSP-16 from 2-4 feet was analyzed past its holding time and its result is only used for qualitative purposes only. No VOCs were detected in any of the soil samples.

5.3.2 Intermediate and Deep Soil Samples

Continuous soil sampling was collected during the installation of intermediate piezometer MW-1I (August 2004), monitoring wells MW-2I and MW-3I (September 2004), and deep piezometer PZ-10D (March 2004). One soil sample from PZ-10D within the lower sand and gravel unit was selected for analysis based on field observations suggesting organic staining similar to that observed at 55 feet in MW-4D. The sample reported no detections of VOCs.

5.4 NATURE AND EXTENT OF GROUNDWATER IMPACT

Groundwater data generated from this RI include 17 grab samples collected from the off-site probes, two grab samples from the Pre PZ-10D soil boring, seven grab samples from the interior source area borings, and the Stage I and Stage II groundwater sampling events that involved 17 and 22 wells, respectively. The Stage I groundwater samples were collected from 11 selected shallow, four intermediate, and two deep monitoring wells; the Stage II groundwater samples were collected from 13 selected shallow, seven intermediate, and two deep monitoring wells.

The following sections describe the nature and extent of impact in the shallow, intermediate, and deep groundwater zones. The data from laboratory analysis of the samples are summarized on Tables 6 through 9 with the full laboratory reports presented in Appendix D. In addition, the cumulative CVOC concentrations from laboratory testing of shallow, intermediate, and deep groundwater samples are summarized in plan view on Figures 11 and 12 and in cross section on Figures 3 and 4.

5.4.1 Shallow Groundwater Zone

The shallow groundwater was characterized using samples collected from 17 Stage I off-site probes in February-April 2004 and 11 shallow monitoring wells that were sampled in April 2004. The analytical data is combined on Figure 12 to provide a comprehensive distribution of groundwater concentrations in the general site vicinity and extending west-southwest.

The data indicate that CVOC impact likely originates near RW-3 where DNAPL is present and extends downgradient towards the west. The extent of impact is defined towards the north by MW-10 and MW-12.

The primary CVOC constituent is PCE, ranging from 0.0049 mg/L at OSP-15 to 5.5 mg/L at OSP-13. Degradation products of PCE are most apparent in the monitoring wells in the southern and western portion of the facility where TCE, cis-1,2-DCE, and vinyl chloride are observed at concentrations approaching or matching those of PCE. Monitoring wells MW-3, MW-4, MW-13, and RW-1 all demonstrate high concentrations of cis-1,2-DCE when compared to PCE, with MW-3 reporting 0.11 mg/L cis-1,2-DCE to 0.11 mg/L PCE. Neighboring samples MW-11 and MW-14 also reported a strong presence of these constituents.

The Stage II groundwater sampling event conducted in September 2004 reported similar concentrations to those reported during the Stage I groundwater sampling event. The most significant change in CVOC concentration between the two sampling events was observed at well MW-4 where PCE increased from 3.6 mg/L in April 2004 to 10 mg/L in September 2004. Cis-1,2-DCE and TCE also observed three-fold increases in MW-4 during the September 2004 sampling event. The remaining shallow monitoring wells were generally consistent between events. The increased concentrations at MW-4 likely result from a lowering of the DNAPL pool by operation of RW-3. Lowering of the DNAPL level allows groundwater to pass through a zone that was previously saturated with PCE, temporarily creating more dissolution of PCE from the residual DNAPL that is sorbed to the soil in that zone.

5.4.2 Intermediate Groundwater Zone

The intermediate groundwater zone was characterized during the RI-Phase II investigation by the analytical results from two groundwater sampling events: the Stage I groundwater sampling event in April 2004 comprising the existing intermediate monitoring wells MW-4I, MW-6I, MW-13I, and MW-14I; and the Stage II event in September 2004 that included the existing wells plus the newly installed piezometer MW-1I and monitoring wells MW-2I, and MW-3I. The new well/piezometer locations were installed in August and September 2004 to laterally delineate to the north, south, and east the groundwater impact previously observed at well MW-4I. The locations of the intermediate piezometer and monitoring wells are presented with the analytical results reported from the Stage II sampling event on Figure 12.

The groundwater analytical results of the Stage I sampling event continued to identify CVOC impact at MW-4I with PCE detected at 4.7 mg/L with TCE and cis-1,2-DCE present at 1.3 mg/L and 0.81 mg/L, respectively. No VOCs were reported at monitoring well MW-13I. MW-14I detected a trace concentration of cis-1,2-DCE at 0.00045 mg/L, below its reporting limit of 0.001

mg/L. The groundwater results from MW-6I only identified a trace concentration of 2-butanone (0.00071 mg/L), which is considered suspect because 2-butanone is a common laboratory artifact which the laboratory detected in an associated method blank during the September 2004 monitoring event.

A groundwater grab sample collected in February 2004 from the intermediate groundwater zone at Pre PZ-10D (Table 6) did not detect any CVOCs, thus helping to delineate the CVOC impact within the intermediate zone towards the northeast.

The Stage II sampling event results within the intermediate groundwater zone, as illustrated on Figure 12, identify CVOC impact in MW-4I and the northern well MW-2I at ppm concentrations, with significantly lower CVOC concentrations detected towards the east (MW-1I), and near trace concentrations reported towards the south (MW-3I). PCE was detected in MW-4I and MW-2I at 5.3 mg/L, with MW-4I also reporting detections of TCE and cis-1,2-DCE at 1.6 mg/L, and 0.56 mg/L, respectively. Piezometer MW-1I reported the presence of PCE at 0.058 mg/L with lower concentrations of TCE (0.015 mg/L), cis-1,2-DCE (0.0023 mg/L), and trace detections of trans-1,2-DCE (0.0007 mg/L), and 1,2,4-trichlorobenzene (0.0005 mg/L). The southern well, MW-3I identified low levels of cis-1,2-DCE and PCE at 0.0033 mg/L and 0.00049 mg/L, respectively. Trace detections of cis-1,2-DCE and PCE (0.00034 mg/L and 0.00013 mg/L, respectively) were reported towards the southwest at MW-14I. No VOCs were detected in MW-13I or MW-6I during this groundwater sampling event.

The groundwater general chemistry measurements among the intermediate wells during both sampling events identify temperatures generally above 60 degrees Fahrenheit (°F) with low dissolved oxygen levels (less than 0.3 mg/L) and negative ORP values (less than -70 mV), suggesting a reducing environment. Values of pH are between 6.9 and 7.8 with specific conductance concentrations ranging from 600 µS/cm to 1,400 µS/cm. Interior piezometer MW-1I field measurements of pH (12.4) and specific conductance (5,397 µS/cm) suggest potential cement grout contamination during piezometer installation. These elevated field measurements will be verified during subsequent sampling events, but are expected to clear up with further purging/sampling over time.

5.4.3 Deep Groundwater Zone

The deep groundwater zone characterization includes continued sampling from the two deep monitoring wells, MW-4D and MW-6D. The reported concentrations of PCE in MW-4D have continually diminished from 0.0062 mg/L in February 2003 to 0.0024 mg/L in April 2004 and 0.0015 in September 2004. TCE detections in MW-4D ranged from 0.0042 mg/L in February 2003 to 0.0035 mg/L in April 2004 and 0.004 mg/L in September 2004. Cis-1,2-DEC was detected in MW-4D during both events of the RI Phase II investigation at concentrations below 0.001 mg/L. No detections have been reported from MW-6D during any sampling event.

The deep monitoring well data from the sampling events report temperatures between 57°F and 61°F with low dissolved oxygen levels (0.31 mg/L or lower) and negative ORP values (less than -28 mV), also suggesting a reducing environment. Values of pH are below 7.0 at MW-6D (6.16 and 6.24) and above 7.0 at MW-4D (7.29 and 7.71) with specific conductance concentrations ranging from 775 µS/cm to 1,100 µS/cm.

5.5 DNAPL EVALUATION

RW-3 was installed during the Phase I RI as a potential recovery well for dissolved phase PCE. After several development and sampling activities, it was later found to contain free-phase or DNAPL PCE. The DNAPL had all the appearance and properties of dry cleaning fluid except for an amber color, potentially extracted from organics in the soil column. Up to 1.71 feet of separate phase liquid was measured in the well. The well has a sump of approximately 1.25 feet into the underlying till, which results in 0.46 feet of DNAPL thickness above the top of till surface at that location. The DNAPL was presumed to be contained by a depression in the top of till surface, the size of which was not known.

Phase II RI activities helped refine the definition of the top of till topography such that it now appears that the initial DNAPL pool was confined to an area of less than 110 square feet in the vicinity of RW-3, GP-15, IB-5, IB-6, and IB-7 (Figure 13) prior to remediation. The area shrank considerably to approximately 26 square feet through the removal of approximately 135 gallons of DNAPL such that no free-phase product was detected in IB-5, IB-6, or IB-7 when they were installed for the Phase II RI. Currently, no significant DNAPL thickness is observed at RW-3 suggesting that DNAPL is at or below the top of till elevation present there. No DNAPL thickness was registered in GP-15 in the short time that it was open as a piezometer, during the Phase I investigation, but the slightly greater depth to till (0.3 feet below that of RW-3) suggests there may be a small amount of DNAPL remaining that cannot be recovered via RW-3.

6.0 CONCLUSIONS

As noted in Section 3.1, the objectives of the RI-Phase II were to 1) delineate the offsite shallow groundwater impact identified downgradient of the facility, 2) define the nature and extent of CVOC impact identified in the intermediate monitoring well MW-4I, 3) provide further characterization of the groundwater flow conditions of the intermediate and deep groundwater zones and to evaluate the hydraulic relationship between these units and the shallow aquifer, and 4) further evaluate the extent of DNAPL impact. The following sections summarize the conclusions of the RI relative to these objectives.

6.1 NATURE AND EXTENT OF OFFSITE IMPACT (SHALLOW GROUNDWATER ZONE)

The offsite investigation of the nature and extent of impact to groundwater covered an area of approximately 10 acres in the direction of shallow groundwater flow. The distribution of impact to the shallow zone is best illustrated by Figure 11, which shows the plume extending in a west-southwesterly direction from the facility. The downgradient and lateral extent of impact was not delimited by the assessment but the configuration of the plume is well-defined.

A separate area of impact is suggested by two data points northwest of the facility (OSP-10 and OSP-13). Because groundwater does not flow to the northwest in the shallow zone and the top-of-till surface does not slope that direction, it appears that the impact may not have originated on site.

Upgradient impact to shallow groundwater is suggested by the presence of PCE in upgradient well MW-6. Testing of shallow groundwater further upgradient at OSP-17 also identified PCE impact but the concentration was less than that of MW-6, leaving in question whether the impact resulted from offsite sources. No onsite source of impact has been identified in that vicinity.

6.2 NATURE AND EXTENT OF IMPACT TO THE INTERMEDIATE GROUNDWATER ZONE

Significant PCE impact to the intermediate groundwater zone was identified at MW-4I during the Phase I RI effort. The extent of impact was delineated by installation and testing of three additional intermediate wells (MW-1I, MW-2I, and MW-3I). Data from these wells, along with the four other intermediate zone wells indicate that the impact is not centered under the building,

as is the case with the shallow zone. Rather, the impact is greatest in wells MW-2I and MW-4I located outside the western wall of the facility. The impact is likely to have migrated from the shallow zone, but the point or area of migration through the intervening T-2 till is unclear since groundwater at MW-1I, located near the shallow zone source area, is relatively clean.

The limited extent of impact in the intermediate zone to the west, east, and south of MW-4 is likely due to the lenticular character of sand deposits that make up the zone. The extent of impact to the north of MW-4 is not known but is expected to be limited at some point on site or relatively close to the site, given the character of the zone.

6.3 GROUNDWATER FLOW CONDITIONS

The hydraulic testing results identified a strong connection between the pumping of the bedrock aquifer at FC-11 and the intermediate and deep groundwater elevations, flow direction, and gradient. Review of individual well response to FC-11 pumping activities suggests that the hydraulic connection between the bedrock aquifer and the deep groundwater zone is located south-southeast of the facility. Because FC-11 is pumped most of the year, the net flow direction in the deep groundwater zone is to the south-southeast toward the centerline of the buried valley over which Fall Creek flows.

A similar hydraulic response to FC-11 pumping in intermediate wells MW-13I and MW-14 suggests a connection between the intermediate zone and the bedrock aquifer somewhere west of these two wells. The net direction of groundwater flow is therefore to the west. The hydraulic gradient is variable across the site; very flat beneath the building, steepening at the front of the building and flattening again from the front to the west side of Keystone Avenue. This variation likely reflects the discontinuous nature of the sand deposits that constitute the intermediate zone.

Pumping activities at FC-11 did not impact the shallow groundwater zone. Groundwater flow in the shallow zone continues to be to the west-southwest except where captured by pumping of RW-1 at the southwestern corner of the Tuchman property. An observed drawdown of 0.05 feet or greater was observed in shallow monitoring wells MW-9, MW-5, MW-1, MW-8, MW-7, MW-3, and MW-11, indicating a 0.05-foot drawdown radius of 60 to 70 feet from RW-1.

Cyclic pumping from the Tuchman production well does not significantly impact groundwater flow in the deep, intermediate, or shallow groundwater zones.

6.4 FURTHER EVALUATION OF EXTENT OF DNAPL IMPACT

Further evaluation of the extent of DNAPL impact was conducted through the Phase II investigation because removal of DNAPL is critical to control of groundwater impact and remediation of the site. The investigation indicated that the area of DNAPL impact is limited to the immediate proximity of RW-3 and possibly GP-15. These points are very close to one another (approximately 5 feet distance) and are closely surrounded by points having no indication of DNAPL impact. When these spatial data are reviewed in context of the DNAPL recovery data for RW-3, it appears that the current area of impact may cover less than 30 square feet north of the RW-3 location. The thickness of DNAPL in this zone started out at 0.46 feet above the top of till in RW-3 and approximately 135 gallons of DNAPL were removed before the rate of recovery slowed appreciably. No DNAPL thickness was registered in GP-15 in the short time that it was open as a piezometer, but the slightly greater depth to till (0.3 feet below that of RW-3) suggests there may be a small amount of DNAPL (on the order of 10 gallons) remaining that cannot be recovered via RW-3.

7.0 REFERENCES

- Alt & Witzig, 1989a, Subsurface Investigation: Tuchman Cleaners, Indianapolis, Indiana; *Prepared for* W.G. Gentry, Lafayette, Indiana, May 11, 1989.
- Alt & Witzig, 1989b, Subsurface Investigation of Properties Adjacent to Tuchman Cleaners; *Prepared for* Tuchman Cleaners, Indianapolis, Indiana, August 22, 1989.
- Alt & Witzig, 1989c, Subsurficial Investigation of Contaminant Plume: Tuchman Cleaners Facility, Indianapolis, Indiana; *Prepared for* Tuchman Cleaners, Indianapolis, Indiana, December 6, 1989.
- Alt & Witzig, 1989d, Letter to the Leaking Underground Storage Tank, IDEM regarding the abandonment in place of 1,000 gallon stoddard solvent tank, Tuchman Cleaners, Indianapolis, Indiana, December 19, 1989.
- Alt & Witzig, 1990, Remedial Design for Tuchman Cleaners, Indianapolis, Indiana (Corrective Action Plan); *Prepared for* Tuchman Cleaners, Indianapolis, Indiana, June 26, 1990.
- Alt & Witzig, 1993, Subsurface Investigation: Tuchman Cleaners, Indianapolis, Indiana; *Prepared for* Tuchman Cleaners, Indianapolis, Indiana, April 1, 1993.
- Cohen, R.M., A.P. Bryda, S.T. Shaw, and C.P. Spalding, 1992, Evaluation of visual methods to detect NAPL in soil and water; Ground Water Monitoring Report, v.12, no.4, pg.132-141.
- Dames & Moore, 1994, Report: Evaluation of Investigation and Remediation Activities: Tuchman Cleaners, Indianapolis, Indiana, May 19, 1994; Dames & Moore Job No. 18817-011-017.
- Dames & Moore, 1995a, Draft Report: Remediation Assessment and Ground Water Assessment: Tuchman Cleaners, Indianapolis, Indiana, March 29, 1995; Dames & Moore Job No. 30351-001-121.
- Dames & Moore, 1995b, Report: Remediation Assessment and Ground Water Assessment: Tuchman Cleaners, Indianapolis, Indiana, October 3, 1995; Dames & Moore Job No. 30351-001-121.
- Dames & Moore, 1996, Draft Report: Phase II Investigation/Remediation: Tuchman Cleaners, 4401 North Keystone Drive, Indianapolis, Indiana, January 16, 1996; Dames & Moore Job No. 30351-001-121.

- Dames & Moore, 1997, Report: Groundwater Remediation Monitoring December 1995 through January 1997: Tuchman Cleaners, 4401 North Keystone Avenue, Indianapolis, Indiana; *Prepared for Dryclean USA*, February 27, 1997; Dames & Moore Job No. 30351-004-121.
- Dames & Moore, 1998, Draft Summary Report: Groundwater Remediation Monitoring December 1995 through December 1997: Tuchman Cleaners, 4401 North Keystone Avenue, Indianapolis, Indiana; *Prepared for Dryclean USA*, March 27, 1998; Dames & Moore Job No. 30351-007-121.
- Dames & Moore, 1999, Draft Summary Report: Groundwater Remediation Monitoring December 1995 through December 1998: Tuchman Cleaners; *Prepared for Dryclean USA*, 4401 North Keystone Avenue, Indianapolis, Indiana, March 1, 1999; Dames & Moore Job No. 30351-009-121.
- ESRI/FEMA. Environmental Systems Research Institute (ESRI)/Federal Emergency Management Agency (FEMA)., 2002. Flood Hazard Areas Zip Code 46025 Marion County, Indiana. <http://www.esri.com/hazards>.
- Indiana Department of Natural Resources (IDNR)-Division of nature Preserves, 1999a, List Of Endangered, Threatened And Rare Species By County <http://www.state.in.us/dnr/naturepr/species/index.htm>
- Indiana Department of Natural Resources (IDNR)-Division of Water Resources. 1999b, Indiana Drainage Handbook, Appendix H.2, U.S. FWS List of Indiana Streams and Habitats Associated with Endangered Species. <http://www.ai.org/dnr/water/DrainageHandbook/>
- Indiana Geological Survey, 2000, The hydrogeologic framework of Marion County, Indiana: A digital atlas illustrating hydrogeologic terrain and sequence, Editors: Steven E. Brown and Andrew J. Laudick, Indiana Geological Survey Open-File Study 00-14.
- Hellmich, Ron. Ecologist IDNR Division of Nature Preserves, 2002, Personal communication with John Hartung (URS) on January 31, 2002.
- Pennsylvania Department of Conservation and Natural Resources (PDCN)., 2002 Endangered and Threatened Species of Pennsylvania, <http://www.dcnr.state.pa.us/wrcf/ksnake.htm>
- Sturm, R. H. and R. H. Gilbert, 1978, Soil Survey of Marion County, Indiana, U.S. Department of Agriculture, Soil Conservation Service in cooperation with Purdue University Agricultural Experiment Station.
- Truatman, M. B., 1957. The Fishes of Ohio. Ohio State University Press.
- United State Geological Survey. 2002. Daily Mean Discharge for USGS Station #03352500, Fall Creek at Millersville, IN.

URS Dames & Moore, 2000, Draft Summary Report: Groundwater Remediation Monitoring December 1995 through December 1999: Tuchman Cleaners, 4401 North Keystone Avenue, Indianapolis, Indiana; *Prepared for* DCI Management, March 28, 2000; Dames & Moore Job No. 30351-011-121.

URS Dames & Moore, 2001, Draft Summary Report: Groundwater Remediation Monitoring December 1995 through December 2000: Tuchman Cleaners, 4401 North Keystone Avenue, Indianapolis, Indiana; *Prepared for* DCI Management, May 22, 2001; Dames & Moore Job No. 30351-011-121.

URS, 2003, Remedial Investigation Report: Tuchman Cleaners, 4401 North Keystone Avenue, Indianapolis, Indiana; *Prepared for* National Dry Cleaners, Inc., April 4, 2003; URS Job No. 30351-025-121.

TABLE 1

**CONTAMINANT REMOVAL EVALUATION - RW-1 GROUNDWATER EXTRACTION
DECEMBER 1995 THROUGH NOVEMBER 2004
REMEDIAL INVESTIGATION - PHASE II**

**TUCHMAN CLEANERS
4401 N. KEYSTONE AVENUE
INDIANAPOLIS, INDIANA**

Groundwater Extraction and Air Stripping -- RW-1 Only

Date	Cumulative Groundwater Pumped (gallons)	Period Pumping Total (gallons)	VOC Concentration¹ (mg/L)	PCE Removed * (pounds)
12/95 - 12/02	29,852,213	NA	0.668 - 6.11	479.30
09/09/03	Well reconditioned with hydrochloric acid and sodium hypochlorite			
10/29/03	6,730,850	NM	0.6856	NA
11/11/03	6,862,350	131,500	1.946	1.44
01/05/04	7,251,840	389,490	2.5263	7.27
01/13/04	7,350,730	98,890	2.5263	2.08
01/23/04	7,416,850	66,120	1.9292	1.23
02/02/04	7,586,930	170,080	1.9292	2.74
02/12/04	7,688,860	101,930	1.834	1.60
02/25/04	7,805,960	117,100	1.834	1.79
03/05/04	7,933,980	128,020	1.834	1.96
03/19/04	8,106,770	172,790	1.5415	2.43
04/26/04	8,554,840	448,070	1.8784	6.39
6/4/2004	8,969,290	414,450	1.7931	6.35
7/12/04	9,427,830	458,540	2.2399	7.72
7/19/04	9,428,270	440	2.2399	0.01
8/18/04	9,502,220	73,950	2.2399	1.38
9/13/04	9,587,280	85,060	1.5908	1.36
9/29/2004	9,796,110	208,830	1.0544	2.30
11/11/03	10,018,780	222,670	1.0544	1.96
Totals:	39,870,993	3,287,930.00		529.32

*Mass Removal = Period Pumping Total X PCE Concentration

¹Where no sample was taken, the concentration is based on the nearest sample event.

TABLE 2

**CONTAMINANT REMOVAL EVALUATION - DNAPL REMOVAL
REMEDIAL INVESTIGATION - PHASE II**

**TUCHMAN CLEANERS
4401 N. KEYSTONE AVENUE
INDIANAPOLIS, INDIANA**

Manual DNAPL Pumping (before installation of automatic DNAPL pump)

Date	Continuous Pumping Period (hours)	Period Pumping Total (gallons DNAPL)	Extractin Rate (gallon / hour)	PCE Removed (pounds)
10/22/03	1.5	2.3	1.53	31.14
10/29/03	3	3.5	1.17	47.38
11/11/03	4.5	3.5	0.78	47.38
11/13/03	3	3.5	1.17	47.38
Total:		12.8		173.29

Automatic DNAPL Pumping

Date	Pumping Period (days)	Period Pumping Total (gallons DNAPL)	Average Extraction Rate (gallons/days)	PCE Removed (pounds)
11/27/03	DNAPL Pumping System online and being tested for optimum pumping rate			
12/2/03	Begin pumping continuously; still adjusting rate			
12/4/03	2	13	6.50	175.99
12/5/03	1	20.5	20.50	277.53
12/8/03	3	16.3	5.43	220.67
12/19/03	11	5	0.45	67.69
1/5/04	Pump placed back online			
1/13/04	8	20.6	2.58	278.88
1/23/04	10	20.6	2.06	278.88
2/2/04	10	5.2	0.52	70.40
2/12/04	10	4.3	0.43	58.21
2/25/04	13	3.2	0.25	43.32
3/5/04	9	3.65	0.41	49.41
3/19/04	14	0.86	0.06	11.64
4/26/04	38	2.58	0.07	34.93
7/12/04	77	3.44	0.04	46.60
8/18/04	37	1.72	0.05	23.30
11/11/04	85	0.86	0.01	11.65
Total:		121.8		1,649.11

*Pump shut down and returned to manufacturer for repair.

Total DNAPL Recovery (as PCE, manually and automatically) 1,822.40

Conversions:

1 gallon = 3.785 Liters = 0.1337 CF 1 gallon PCE = 13.54 pounds PCE
PCE_{sg} = 1.6227 453.6 g = 1 pound

55-gallon drum dimensions are: 22.5 inches diameter by 32 inches height

TABLE 3
GROUNDWATER ELEVATIONS
FIELD ACTIVITIES
REMEDIAL INVESTIGATION - PHASE II
TUCHMAN CLEANERS
4401 NORTH KEYSTONE AVENUE
INDIANAPOLIS, INDIANA

Well No.	Reference Elevation* (feet)	2/19/03	3/19/04	4/6/04	9/13/04	11/11/04
		Groundwater Elevation (feet)	Groundwater Elevation (feet)	Groundwater Elevation (feet)	Groundwater Elevation (feet)	Groundwater Elevation (feet)
MW-1	728.16	715.78	717.26	717.86	717.10	-
MW-1I	728.56	-	-	-	711.52	715.85
MW-2I	727.51	-	-	-	710.09	717.49
MW-3	727.2	715.87**	717.37	717.99	717.20	-
MW-3I	727.66	-	-	-	709.98	717.53
MW-4	727.71	715.80	717.29	717.91	717.12	-
MW-4I	727.55	714.40	709.76	715.94	709.93	717.47
MW-4D	727.56	710.16	707.20	708.41	707.70	715.15
MW-5	727.84	715.76	717.16	717.77	717.02	-
MW-6	728.33	716.14	717.86	718.55	716.72	-
MW-6I	728.22	714.25	710.98	716.26	711.91	717.54
MW-6D	728.2	710.46	707.71	709.07	708.05	715.19
MW-7	728.22	715.82	717.39	718.01	717.29	-
MW-8	727.87	715.82	717.31	717.92	717.17	-
MW-9	727.81	715.79	717.06	717.64	716.86	-
MW-10	728.56	715.92	717.48	718.14	717.37	-
MW-11	727.49	715.74	717.19	717.83	717.10	-
MW-12	728.08	715.72	717.18	717.83	716.12	-
MW-13	729.05	715.19	716.38	716.88	716.34	-
MW-13I	729.05	715.17	709.50	715.91	709.71	717.54
MW-14	728.4	715.21	716.47	716.93	716.37	-
MW-14I	728.4	715.00	709.51	715.90	709.75	717.55
MW-15	728.43	715.95	717.58	718.28	717.48	-
MW-16	727.37	716.02	717.73	718.35	717.56	-
MW-17	727.88	715.67	716.91	717.49	716.76	-
OSP-3	727.37	-	715.26	715.57	715.13	-
OSP-4	737.21	-	715.16	715.54	715.03	-
OSP-9	737.68	-	-	-	714.18	-
OSP-13	731.37	-	716.37	716.96	716.41	-
PZ-10D	727.99	-	711.77	712.79	709.63	715.09

* Monitoring wells were surveyed on February 20-26, 2003 by Beacon Engineering of Indianapolis, Indiana. Reference elevations are relative to NAD 27 sea level datum.

** Water level taken the following day (2/20/03) because the well was inaccessible on February 19, 2003 (covered by substantial slush and water).

"-" = Monitoring locations not present at time of water level measurement (monitoring wells installed in February, 2003; off-site probes [OSP] and PZ-10D were installed between February and April 2004; and intermediate wells/piezometers P-11, MW-21, and MW-3I were installed in August and September 2004).

TABLE 4
GROUNDWATER DRAWDOWN EVALUATION - RW-1 PUMP TEST
STAGE I FIELD ACTIVITIES
REMEDIAL INVESTIGATION - PHASE II
TUCHMAN CLEANERS
4401 NORTH KEYSTONE AVENUE
INDIANAPOLIS, INDIANA

Well No.	Reference Elevation* (feet)	3/22/2004 - RW-1 Pump Test		
		Static Groundwater Elevation (feet)	Pump Induced Groundwater Elevation (feet)	Drawdown Due to Pumping* (feet)
MW-1	728.16	717.45	717.36	0.09
MW-3	727.2	717.52	717.46	0.06
MW-4	727.71	717.46	NM	NA
MW-4I	727.55	715.75	NM	NA
MW-4D	727.56	712.11	NM	NA
MW-5	727.84	717.41	717.25	0.16
MW-6	728.33	717.92	717.94	-0.02
MW-6I	728.22	713.6	NM	NA
MW-6D	728.2	712.15	NM	NA
MW-7	728.22	717.53	717.48	0.05
MW-8	727.87	717.48	717.41	0.07
MW-9	727.81	717.4	717.11	0.29
MW-10	728.56	717.59	717.58	0.01
MW-11	727.49	717.33	717.28	0.05
MW-12	728.08	717.3	NM	NA
MW-13	729.05	716.43	716.44	-0.01
MW-13I	729.05	716.02	NM	NA
MW-14	728.4	716.45	716.54	-0.09
MW-15	728.43	717.71	717.69	0.02
MW-17	727.88	717.31	NM	NA
OSP-3	727.37	715.26	715.29	-0.03
OSP-4	737.21	715.16	715.15	0.01
OSP-13	731.37	716.39	716.42	-0.03

* Monitoring wells were surveyed on February 20-26, 2003 and April 21, 2004 by Beacon Engineering of Indianapolis, IN. Reference elevations are relative to NAD 27 sea level datum.

** Negative values reflect a rise in groundwater elevation since pumping began.

NA = Drawdown Difference value not available

NM = Not Measured

TABLE 5

ANALYTICAL RESULTS SUMMARY
SOIL SAMPLING
REMEDIAL INVESTIGATION - PHASE II

TUCHMAN CLEANERS
4401 NORTH KEYSTONE AVENUE
INDIANAPOLIS, INDIANA

Parameters	RISC Closure Level*		Soil Borings		
	Residential	Industrial	OSP-11 (0-2 ft)	OSP-14 (14-16 ft)	OSP-16 (2-4 ft) PZ-10D (58 ft)
Volatile Organic Compounds (mg/kg)					
cis-1,2-Dichloroethene	0.4	5.8	-	-	-
Tetrachloroethene	0.058	0.64	-	-	-
Trichloroethene	0.057	3	-	-	-

☐ = Concentration exceeds RISC closure level for a residential setting

* = RISC Closure levels are derived from Table A within Appendix A of the
Indiana Department of Environmental Management (IDEM)
Risk Integrated System of Closure (RISC) Technical Guide (July 24, 2001)

TABLE 6

ANALYTICAL RESULTS SUMMARY
GROUNDWATER SAMPLING - STAGE I OFFSITE PROBE INVESTIGATION
FEBRUARY TO APRIL 2004
REMEDIAL INVESTIGATION - PHASE II

TUCHMAN CLEANERS
4401 KEYSTONE AVENUE
INDIANAPOLIS, INDIANA

Parameters	RISC Closure Level*		Off-Site Probe (OSP) Locations								
	Residential	Industrial	OSP-1	OSP-2	OSP-3	OSP-4	OSP-4 Dup OSP-100	OSP-5	OSP-6	OSP-7	OSP-8
Volatile Organic Compounds (mg/L)											
Acetone	0.950	92.000	-†	-†	-†	-†	-†	-†	-†	-†	-†
Benzene	0.005	0.052	-	-	-	-	-	-	-	-	-
Bromodichloromethane	0.080	0.080	-	-	-	-	-	-	-	-	-
2-Butanone	-	-	-	-	-	-†	-†	-	-	-	-
Carbon Tetrachloride	0.005	0.022	-	-	-	-	-	-	-	0.0013 J	-
Chloroform	0.080	1.000	-	-	-	-	-	-	-	0.0016 J	-
1,1-Dichloroethane	0.007	10.000	-	-	-	0.0028 J	0.0035 J	-	-	-	-
cis-1,2-Dichloroethene	0.070	1.000	0.042	0.059 J	0.0041 J	0.016	0.018	0.25	0.022 J	0.019	0.069
trans-1,2-Dichloroethene	0.100	2.000	-	-	-	-	-	-	-	0.0011 J	-
Ethylbenzene	0.700	10.000	-	-	-	-	-	-	-	-	-
Methylene Chloride	0.005	0.380	-†	-	-†	-†	-†	0.011 J	0.016 J	-†	-†
Tetrachloroethene	0.005	0.055	0.8	1.4	0.19	0.14	0.14	1.3	1.5	0.12	0.89
Toluene	1.000	20.000	-	-	-	-	-†	-	-	0.00088 J	-
1,1,1-Trichloroethane	0.200	29.000	-	-	-	0.027	0.025	-	-	0.02	0.016
Trichloroethene	0.005	0.050	0.021 J	0.08	0.0024 J	0.013	0.014	0.1	0.014 J	0.0067	0.037
Cumulative CVOC Concentration											
			0.863	1.539	0.1965	0.1718	0.1755	1.65	1.536	0.1468	0.996

□ = Concentration exceeds RISC closure level for a residential setting

* = RISC Closure levels are derived from Table A within Appendix A of the Indiana Department of Environmental Management (IDEM) Risk Integrated System of Closure (RISC) Technical Guide (July 24, 2001)

CVOC = Chlorinated volatile organic compounds

B = Constituent detected in Method Blank

J = Estimated value

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank. In accordance with the U.S. EPA Contract Laboratory Program National Functional Guidelines or Low Concentration Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

TABLE 6 (Continued)

Parameters	RISC Closure Level*		Off-Site Probe (OSP) Locations									
	Residential	Industrial	OSP-9	OSP-10	OSP-10 Dup OSP-100	OSP-11	OSP-12	OSP-13	OSP-14	OSP-15	OSP-16	OSP-17
Volatile Organic Compounds (mg/L)												
Acetone	0.950	92.000	-†	0.14 J	-	-†	-†	-†	-	-†	-†	-†
Benzene	0.005	0.052	-	-	-	-	-	-	0.00058 J	0.00059 J	0.00029 J	0.00035 J
Bromodichloromethane	0.080	0.080	-	-	-	-	-	-	-	0.00064 J	-	-
2-Butanone	-	-	-	-	-	0.0027 J	-	-	-	0.0014 J	-	-
Carbon Tetrachloride	0.005	0.022	-	-	-	-	-	-	-	-	-	-
Chloroform	0.080	1.000	-	-	-	0.00064 J	0.067	-	-	0.018	0.00031 J	-
1,1-Dichloroethane	0.007	10.000	-	-	-	0.00098 J	-	-	-	-	-	-
cis-1,2-Dichloroethene	0.070	1.000	0.0076 J	-	-	0.032	0.15	-	0.0022 J	0.0004 J	-	-
trans-1,2-Dichloroethene	0.100	2.000	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	0.700	10.000	-	-	-	-	-	-	-	-	0.00019 J	-
Methylene Chloride	0.005	0.380	-	-†	-†	-†	-	-†	-	-	-	-
Tetrachloroethene	0.005	0.055	0.44	5	3.5	0.091	1.0	5.5	0.061	0.0049	0.016	0.037 J
Toluene	1.000	20.000	-	-	-	0.00064 J	-	-	0.0012 J	0.00094 J	0.00057 J	0.00066 J
1,1,1-Trichloroethane	0.200	29.000	-	-	-	0.023	0.029 J	-	-	-	-	-
Trichloroethene	0.005	0.050	0.0083 J	-	-	0.023	0.073	-	0.00074 J	-	-	0.0007 J
Cumulative CVOC Concentration			0.4559	5	3.5	0.14698	1.2	5.5	0.06394	0.0053	0.016	0.0377

□ = Concentration exceeds RISC closure level for a residential setting

* = RISC Closure levels are derived from Table A within Appendix A of the Indiana Department of Environmental Management (IDEM)

Risk Integrated System of Closure (RISC) Technical Guide (July 24, 2001)

CVOC = Chlorinated volatile organic compounds

B = Constituent detected in Method Blank

J = Estimated value

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank. In accordance with the U.S. EPA Contract Laboratory Program National Functional Guidelines or Low Concentration Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

TABLE 6 (Continued)

Parameters	RISC Closure Level*		PRE PZ-10D		QA Samples	
	Residential	Industrial	Shallow	Intermediate	Trip Blank 2/27/04	Trip Blank 4/7/04
Volatile Organic Compounds (mg/L)						
Acetone	0.950	92.000	-†	-†	0.0041	JB
Benzene	0.005	0.052	0.00035 J	0.0003 J	-	-
Bromodichloromethane	0.080	0.080	-	-	-	-
2-Butanone			-†	-†	0.0024	J
Carbon Tetrachloride	0.005	0.022	-	-	-	-
Chloroform	0.080	1.000	-	-	-	-
1,1-Dichloroethane	0.007	10.000	-	-	-	-
cis-1,2-Dichloroethene	0.070	1.000	-	-	-	-
trans-1,2-Dichloroethene	0.100	2.000	-	-	-	-
Ethylbenzene	0.700	10.000	-†	-†	-	-
Methylene Chloride	0.005	0.380	-	-	-	-
Tetrachloroethene	0.005	0.055	0.0021	-	-	-
Toluene	1.000	20.000	-†	-†	0.00035 J	-
1,1,1-Trichloroethane	0.200	29.000	-	-	-	-
Trichloroethene	0.005	0.050	-	-	-	-
Cumulative CVOC Concentration			0.0021	0	0.00035	

□ = Concentration exceeds RISC closure level for a residential setting

* = RISC Closure levels are derived from Table A within Appendix A of the Indiana Department of Environmental Management (IDEM)

Risk Integrated System of Closure (RISC) Technical Guide (July 24, 2001)

Trip Blank 2/27/04 shipped with groundwater samples OSP-1, OSP-2, OSP-3, OSP-4, OSP-5, OSP-6, OSP-13, 1B-1, Pre PZ-10DS, Pre PZ-10DI, OSP-100

Trip Blank 4/7/04 was shipped with groundwater samples OSP-7, OSP-8, OSP-9, SPP-10, OSP-11, OSP-12, OSP-15, OSP-16, OSP-17

CVOC = Chlorinated volatile organic compounds

B = Constituent detected in Method Blank; J = Estimated value

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank. In accordance with the U.S. EPA Contract Laboratory Program National Functional Guidelines or Low Concentration Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

TABLE 7

ANALYTICAL RESULTS SUMMARY
INTERIOR SOURCE AREA GROUNDWATER SAMPLING
FEBRUARY AND AUGUST 2004
REMEDIAL INVESTIGATION - PHASE II

TUCHMAN CLEANERS
4401 KEYSTONE AVENUE
INDIANAPOLIS, INDIANA

Parameters	RISC Closure Level*		Interior Source Area Borings					Intermediate	QA Samples		
	Residential	Industrial	IB-1 (2/04)	IB-2 (2/04)	IB-3 (2/04)	IB-4 (8/04)	IB-5 (8/04)	IB-6 (8/04)	IB-7 (8/04)	Trip Blank 2/27/04	Trip Blank 8/17/04
Volatile Organic Compounds (mg/L)											
Acetone	0.950	92.000	-†	-†	-†	-†	-†	-†	-†	-†	0.003 J
Benzene	0.005	0.052			0.00033 J	-†	-†	-	-	-	-†
Bromodichloromethane	0.080	0.080	-	-	-	-	-	-	-	-	-
2-Butanone			-	-	-†	-	-	-	-	0.0067 J	-
Carbon Tetrachloride	0.005	0.022	-	-	-	-	-	-	-	-	-
Chloroform	0.080	1.000	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	0.007	10.000	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	0.070	1.000	-	-	0.00037 J	-	-	-	-	0.0042 J	-
trans-1,2-Dichloroethene	0.100	2.000	-	-	-	-	-	-	-	-	-
Ethylbenzene	0.700	10.000	0.0012 J	-	-	-	-	-	-	-	-
Methylene Chloride	0.005	0.380	-	-	-	-	-	0.012	0.14	-	-
Tetrachloroethene	0.005	0.055	0.068	0.29	0.017	0.075	0.31	0.16	1.1	-	0.04
Toluene	1.000	20.000	-	-	-†	0.0006 J	-	-	-	0.00035 J	-
1,1,1-Trichloroethane	0.200	29.000	-	-	-	-	-	-	-	-	-
Trichloroethene	0.005	0.050	-	-	0.0005 J	0.0012 J	0.0063 J	0.0031 J	-	0.0044 J	0.00057 J
Cumulative CVOC Concentration			0.068	0.29	0.01787	0.0762	0.3163	0.1631	1.1	-	0.2244

□ = Concentration exceeds RISC closure level for a residential setting

* = RISC Closure levels are derived from Table A within Appendix A of the Indiana Department of Environmental Management (IDEM)

Risk Integrated System of Closure (RISC) Technical Guide (July 24, 2001)

Trip Blank 2/27/04 shipped with groundwater samples OSP-1, OSP-2, OSP-3, OSP-4, OSP-5, OSP-6, OSP-13, IB-1, Pre PZ-10DS, Pre PZ-10DI, OSP-100

Trip Blank 4/7/04 shipped with groundwater samples OSP-7, OSP-8, OSP-9, SPP-10, OSP-11, OSP-12, OSP-15, OSP-16, OSP-17

CVOC = Chlorinated volatile organic compounds

B = Constituent detected in Method Blank; J = Estimated value

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank. In accordance with the U.S. EPA Contract Laboratory Program National Functional Guidelines or Low Concentration Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

TABLE 8

ANALYTICAL RESULTS SUMMARY
GROUNDWATER SAMPLING - STAGE I FIELD ACTIVITIES
APRIL 6-8, 2004 EVENT
REMEDIAL INVESTIGATION - PHASE II

TUCHMAN CLEANERS
4401 NORTH KEYSTONE AVENUE
INDIANAPOLIS, INDIANA

Parameters	RISC Closure Level*		Shallow Alluvial							MW-11 DUP (MW-100)
	Residential	Industrial	MW-3	MW-4	MW-5	MW-6	MW-7	MW-11		
TCL Volatile Organics (mg/L)										
Acetone	0.950	92.000	0.0036 J	-†	-†	-†	-†	-	-†	-†
2-Butanone										
cis-1,2-Dichloroethene	0.070	1.0	0.11	0.81	-	-	-	-	-	-
trans-1,2-Dichloroethene	0.100	2.0	-	-	-	-	-	0.062 J	0.06 J	0.06 J
Methylene chloride	0.005	0.380	-	-	-	-	-	-	-	-
Tetrachloroethene	0.005	0.055	-†	-†	-	-	-†	-†	-†	-
Trichloroethene	0.005	0.0072	0.11	3.6	2.5	0.073	0.47	2.7	2.8	
Vinyl Chloride	0.002	0.002	0.013	0.35	-	-	-	0.026 J	0.024 J	
			0.0061	0.12	-	-	-	-	-	-
Cumulative CVOC Concentration			0.2391	4.88	2.5	0.073	0.47	2.788	2.884	
Field Parameters										
Dissolved Oxygen (mg/L)			1.6	0.16	0.12	0.52	1.66	0.12	NA	NA
Oxidation-Reduction Potential (mV)			182.3	-82.2	-9.5	89	121	88.4	NA	NA
Specific Conductance (umhos/cm)			894	1,106	998	1065	989	1030	NA	NA
pH (S.I.)			7.99	7.47	7.59	7.4	7.95	7.76	NA	NA
Temperature (Fahrenheit)			54.86	58.76	60.9	53.04	61.7	59.98	NA	NA

"-" = Below detection limit; TCL = Target Compound List; "*" = Parameters collected from an unpreserved jar sample; NA = Not Analyzed

□ = Concentration exceeds RISC closure level for a residential setting

* = RISC Closure levels are derived from Table A within Appendix A of the Indiana Department of Environmental Management (IDEM) Risk Integrated System of Closure (RISC) Technical Guide (July 24, 2001)

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank.

In accordance with the U.S. EPA Contract Laboratory Program National Functional Guidelines or Low Concentration Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

14944888

Page 2 of 3

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank. In accordance with the U.S. EPA Contract Laboratory Program National Functional Guidelines or Low Concentration Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank.

Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

TABLE 8 (Continued)

Parameters	RISC Closure Level*		Middle Aquifer				Deep Aquifer		Trip Blank	Trip Blank
TCL Volatile Organics (mg/L)	Residential	Industrial	MW-4I	MW-6I	MW-13I	MW-14I	MW-4D	MW-6D	4/7/04	4/8/04
Acetone	0.950	92.000	-†	-†	-	-	-	-†	0.00074 J	-
2-Butanone			-	0.00071 J	-	-	-	-	-	-
cis-1,2-Dichloroethene	0.070	1.0	0.81	-	-	0.00045 J	0.00078 J	-	-	-
trans-1,2-Dichloroethene	0.100	2.0	-	-	-	-	-	-	-	-
Methylene chloride	0.005	0.380	-†	-	-	-	-	-	-	-
Tetrachloroethene	0.005	0.055	4.7	-	-	-	0.0024	-	-	-
Trichloroethene	0.005	0.0072	1.3	-	-	-	0.0035	-	-	-
Vinyl Chloride	0.002	0.002	-	-	-	-	-	-	-	-
Cumulative CVOC Concentration			6.81	-	-	0.00045	0.00668	-		
Field Parameters										
Dissolved Oxygen (mg/L)			0.28	0.12	0.06	0.07	0.04	0.08		
Oxidation-Reduction Potential (mV)			-105.9	-123.8	-105.4	-74.1	-132	-28.5		
Specific Conductance (µmhos/cm)			848	840	725	646	775	1,088		
pH (S.I.)			7.7	7.67	7.83	7.77	7.71	6.24		
Temperature (Fahrenheit)			60.4	58.04	60.6	60.42	58.05	57.75		

"-" = Below detection limit; TCL = Target Compound List; "*" = Parameters collected from an unpreserved jar sample; NA = Not Analyzed

□ = Concentration exceeds RISC closure level for a residential setting

* = RISC Closure levels are derived from Table A within Appendix A of the Indiana Department of Environmental Management (IDEM)

Risk Integrated System of Closure (RISC) Technical Guide (July 24, 2001)

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank.

In accordance with the U.S. EPA Contract Laboratory Program National Functional Guidelines or Low Concentration

Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

TABLE 9

ANALYTICAL RESULTS SUMMARY
GROUNDWATER SAMPLING - STAGE II FIELD ACTIVITIES
SEPTEMBER 13-14, 2004 EVENT
REMEDIAL INVESTIGATION - PHASE II

TUCHMAN CLEANERS
4401 NORTH KEYSTONE AVENUE
INDIANAPOLIS, INDIANA

Parameters	RISC Closure Level*		Shallow Alluvial						
	Residential	Industrial	MW-1	MW-3	MW-4	MW-4 DUP (MW-100)	MW-5	MW-6	MW-7
TCL Volatile Organics (mg/L)									
Acetone	0.950	92.000	- †	- †	- †	-	- †	-	- †
2-Butanone			- †	-	-	- †	- †	-	- †
n-Butylbenzene			0.02 J	-	-	-	-	-	-
sec-Butylbenzene			0.058	-	-	-	-	-	-
Chloroform			-	-	-	-	-	-	-
cis-1,2-Dichloroethene	0.070	1.0	-	0.037	2.7	2.2	0.022 J	-	-
trans-1,2-Dichloroethene	0.100	2.0	-	-	-	-	-	-	-
Isopropylbenzene			0.06	-	-	-	-	-	-
p-Isopropyltoluene			0.027 J	-	-	-	-	-	-
n-Propylbenzene			0.14	-	-	-	-	-	-
Methylene chloride	0.005	0.380	-	-	-	0.12	-	-	-
Tetrachloroethene	0.005	0.055	-	0.11	10.0	7.6	2.5	0.074	0.54
Toluene			-	-	-	-	-	-	-
1,2,4-Trichlorobenzene			-	-	-	-	-	-	-
Trichloroethene	0.005	0.0072	-	0.01	1.0	0.78	0.03 J	-	-
1,2,4-Trimethylbenzene			1.1	-	-	-	-	-	-
1,3,5-Trimethylbenzene			0.089	-	-	-	-	-	-
Vinyl Chloride	0.002	0.002	-	0.0027 J	0.27 J	0.22 J	-	-	-
Cumulative CVOC Concentration									
			0.000	0.160	13.970	10.800	2.552	0.074	0.540

Field Parameters	RISC Closure Level*		Shallow Alluvial						
	Residential	Industrial	MW-4 DUP						
			MW-1	MW-3	MW-4	MW-5	MW-6	MW-7	
Dissolved Oxygen (mg/L)			0.3	0.47	0.37	NA	0.18	0.47	NA
Oxidation-Reduction Potential (mV)			-169	0	-150	NA	20	0	78
Specific Conductance (umhos/cm)			1,094	985	1,060	NA	948.5	982.1	981
pH (S.I.)			6.8	6.87	7.09	NA	7.10	7.12	7.07
Temperature (Fahrenheit)			67.8	67.3	67.1	NA	64.1	65.4	66.5

Dissolved Oxygen (mg/L)
Oxidation-Reduction Potential (mV)
Specific Conductance (μ mhos/cm)
pH (S.I.)
Temperature (Fahrenheit)

Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

TABLE 9 (Continued)

Parameters TCL Volatile Organics (mg/L)	RISC Closure Level*		Shallow Alluvial						
	Residential	Industrial	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16
Acetone	0.950	92.000	-	-	-	-	-	-	-
2-Butanone	-	-	-	-	-	-	-	-	-
n-Butylbenzene	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	-	-	-	-	-	-	-	-	-
Chloroform	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	0.070	1.0	-	0.036 J	-	0.53	0.11	-	-
trans-1,2-Dichloroethene	0.100	2.0	-	-	-	-	-	-	-
Isopropylbenzene	-	-	-	-	-	-	-	-	-
p-Isopropyltoluene	-	-	-	-	-	-	-	-	-
n-Propylbenzene	-	-	-	-	-	-	-	-	-
Methylene chloride	0.005	0.380	-	-	-	-	-	-	-
Tetrachloroethene	0.005	0.055	0.011	2.9	-	2.2	0.8	0.099	0.012
Toluene	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	-	-	-	-	-	-	0.0088 J	-	-
Trichloroethene	0.005	0.0072	0.0008 J	0.039 J	0.00034 J	0.028 J	0.16	-	0.00024 J
1,2,4-Trimethylbenzene	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	-	-	-	-	-	-	-	-	-
Vinyl Chloride	0.002	0.002	-	-	-	0.078 J	-	-	-
Cumulative CVOC Concentration			0.012	2.975	0.000	2.836	1.070	0.099	0.012

TABLE 9 (Continued)

Parameters	RISC Closure Level*		Shallow Alluvial						
	Residential	Industrial	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16
Field Parameters									
Dissolved Oxygen (mg/L)			0.22	0.14	0.14	0.19	0.32	0.13	0.36
Oxidation-Reduction Potential (mV)			81	152	-153	-90	-129	22	-50
Specific Conductance (umhos/cm)			962	1,016	1,035	1,029	997	991.0	888.3
pH (S.I.)			7.45	6.54	7.45	7.29	7.30	7.16	7.27
Temperature (Fahrenheit)			63.2	62.9	64.1	65.9	65.1	63.9	64.2

"-" = Below detection limit

TCL = Target Compound List

* = Parameters collected from an unpreserved jar sample

NA = Not Analyzed

☐ = Concentration exceeds RISC closure level for a residential setting

* = RISC Closure levels are derived from Table A within Appendix A of the Indiana Department of Environmental Management (IDEM) Risk Integrated System of Closure (RISC) Technical Guide (July 24, 2001)

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank.

In accordance with the U.S. EPA Contract Laboratory Program National Functional Guidelines or Low Concentration Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

TABLE 9 (Continued)

Parameters TCL Volatile Organics (mg/L)	Middle Aquifer							
	RISC Closure Level*							
	Residential	Industrial	MW-1I	MW-2I	MW-3I	MW-4I	MW-4I DUP (MW-200)	MW-6I
Acetone	0.950	92.000	- †	- †	- †	- †	- †	- †
2-Butanone			- †	- †	- †	- †	- †	- †
n-Butylbenzene			-	-	-	-	-	-
sec-Butylbenzene			-	-	-	-	-	-
Chloroform			-	-	0.0042	-	-	-
cis-1,2-Dichloroethene	0.070	1.0	0.0023	-	0.0033	0.56	0.57 J	-
trans-1,2-Dichloroethene	0.100	2.0	0.0007 J	-	-	-	-	-
Isopropylbenzene			-	-	-	-	-	-
p-Isopropyltoluene			-	-	-	-	-	-
n-Propylbenzene			-	-	-	-	-	-
Methylene chloride	0.005	0.380	-	0.11 J	-	-	-	-
Tetrachloroethene	0.005	0.055	0.058	5.30	0.00049 J	5.3	5.6	-
Toluene			-	-	-	-	-	-
1,2,4-Trichlorobenzene		-	0.0005 J	-	-	-	-	-
Trichloroethene	0.005	0.0072	0.015	-	-	1.6	1.6	-
1,2,4-Trimethylbenzene			-	-	-	-	-	-
1,3,5-Trimethylbenzene			-	-	-	-	-	-
Vinyl Chloride	0.002	0.002	-	-	-	-	-	-
Cumulative CVOC Concentration			0.076	5.300	0.004	7.460	7.770	0.000

TABLE 9 (Continued)

Parameters	RISC Closure Level*		Middle Aquifer					
	Residential	Industrial	MW-1I	MW-2I	MW-3I	MW-4I	MW-4I DUP (MW-200)	MW-6I
Field Parameters								
Dissolved Oxygen (mg/L)			NS	0.18	0.13	0.04	NA	0.18
Oxidation-Reduction Potential (mV)			-308	-371	-365	-141	NA	-147
Specific Conductance (umhos/cm)			5,397	857.7	605.1	1,046	NA	1,417
pH (S.I.)			12.40	7.16	7.28	7.22	NA	6.94
Temperature (Fahrenheit)			62.4	61.0	61.4	61.8	NA	59.3

"-" = Below detection limit

TCL = Target Compound List

* = Parameters collected from an unpreserved jar sample

NA = Not Analyzed

☐ = Concentration exceeds RISC closure level for a residential setting

* = RISC Closure levels are derived from Table A within Appendix A of the Indiana Department of Environmental Management (IDEM) Risk Integrated System of Closure (RISC) Technical Guide (July 24, 2001)

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank.

In accordance with the U.S. EPA Contract Laboratory Program National Functional Guidelines or Low Concentration Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.

TABLE 9 (Continued)

Parameters TCL Volatile Organics (mg/L)	RISC Closure Level*		Middle Aquifer		Deep Aquifer MW-4D DUP (MW-300)		Trip Blank 9/14/04
	Residential	Industrial	MW-131	MW-141	MW-4D	MW-5D	
Acetone	0.950	92.000	-	-	-	-	- †
2-Butanone	-	-	-	-	-	-	- †
n-Butylbenzene	-	-	-	-	-	-	-
sec-Butylbenzene	-	-	-	-	-	-	-
Chloroform	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	0.070	1.0	-	0.00034 J	0.00041 J	0.0004 J	-
trans-1,2-Dichloroethene	0.100	2.0	-	-	-	-	-
Isopropylbenzene	-	-	-	-	-	-	-
p-Isopropyltoluene	-	-	-	-	-	-	-
n-Propylbenzene	-	-	-	-	-	-	-
Methylene chloride	0.005	0.380	-	-	-	-	-
Tetrachloroethene	0.005	0.055	-	0.00013 J	0.0014	0.0015	-
Toluene	-	-	-	-	-	-	0.00017 J
1,2,4-Trichlorobenzene	-	-	-	-	-	-	-
Trichloroethene	0.005	0.0072	-	-	0.0039	0.004	-
1,2,4-Trimethylbenzene	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	-	-	-	-	-	-	-
Vinyl Chloride	0.002	0.002	-	-	-	-	-
Cumulative CVOC Concentration	0.000	0.000	0.000	0.000	0.006	0.006	0.000

TABLE 9 (Continued)

Parameters	RISC Closure Level*		Deep Aquifer			MW-4D DUP (MW-300)	MW-6D	Trip Blank 9/14/04
	Residential	Industrial	MW-13I	MW-14I	MW-4D			
Field Parameters								
Dissolved Oxygen (mg/L)			0.06	0.10	0.04	NA	0.31	NA
Oxidation-Reduction Potential (mV)			-177	-197	-110	NA	-100	NA
Specific Conductance (umhos/cm)			687.6	617.2	909.5	NA	1,008	NA
pH (S.I.)			7.44	7.48	7.29	NA	6.16	NA
Temperature (Fahrenheit)			61.0	61.8	61.0	NA	59.7	NA

"-" = Below detection limit

TCL = Target Compound List

* = Parameters collected from an unpreserved jar sample

NA = Not Analyzed

☐ = Concentration exceeds RISC closure level for a residential setting

* = RISC Closure levels are derived from Table A within Appendix A of the Indiana Department of Environmental Management (IDEM)

☐ = Risk Integrated System of Closure (RISC) Technical Guide (July 24, 2001)

† = Low level detections were reported for this sample and the associated Method Blank and/or Trip Blank.

In accordance with the U.S. EPA Contract Laboratory Program National Functional Guidelines or Low Concentration Organic Data Review (2001). These detections were qualified as not detected above its respective reporting limit.



LEGEND:

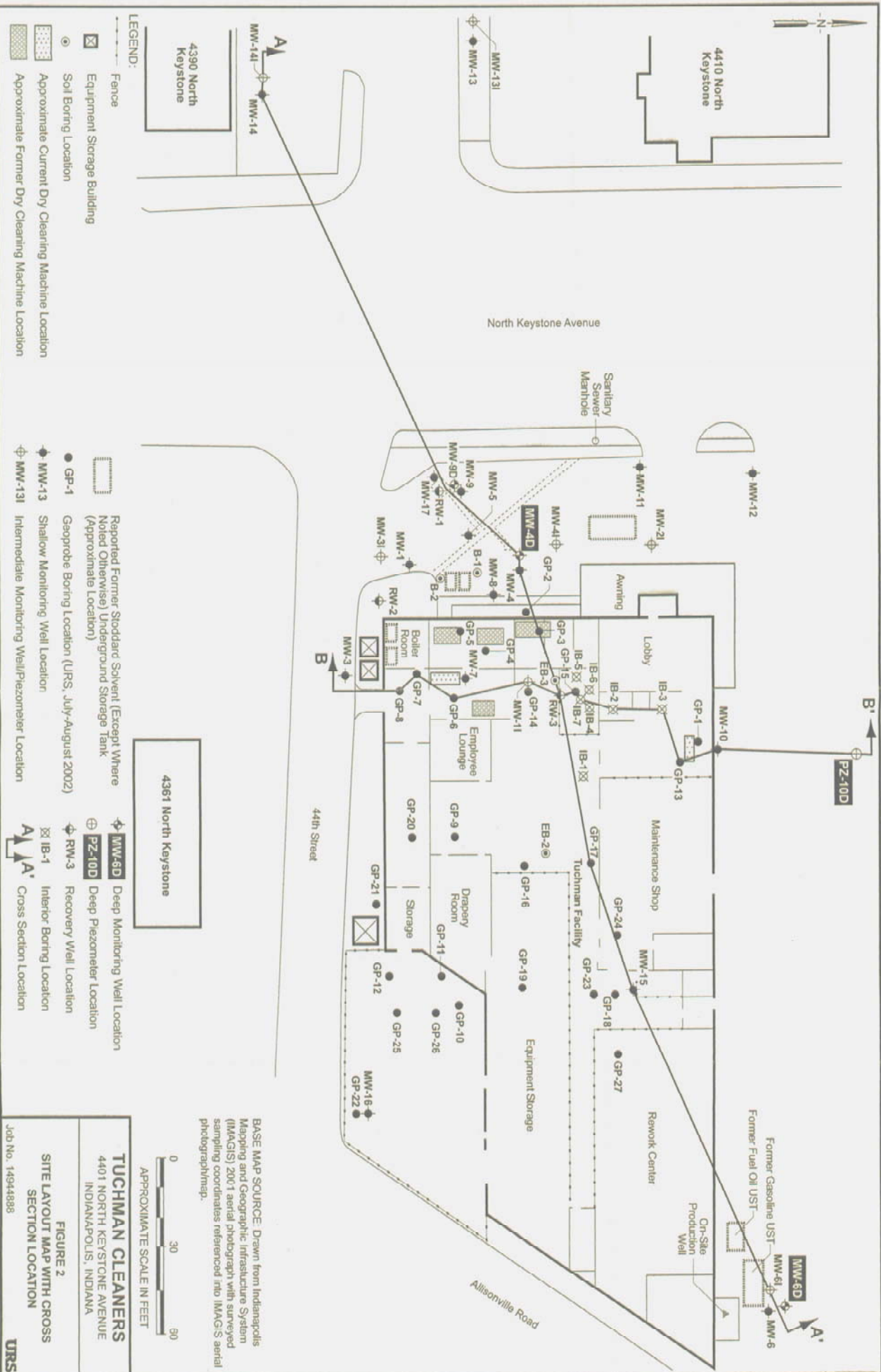
- Off-Site Probe Location and Number
OSP-1
- Off-Site Piezometer Location
OSP-4 and Number
- Shallow Monitoring Well Location
- Deep Monitoring Well or
Piezometer Location
- Intermediate Monitoring Well Location
- Recovery Well Location
- ▲ On-Site Production Well
- Sanitary Sewer Line
- Storm Sewer Line
- Parcel Boundary

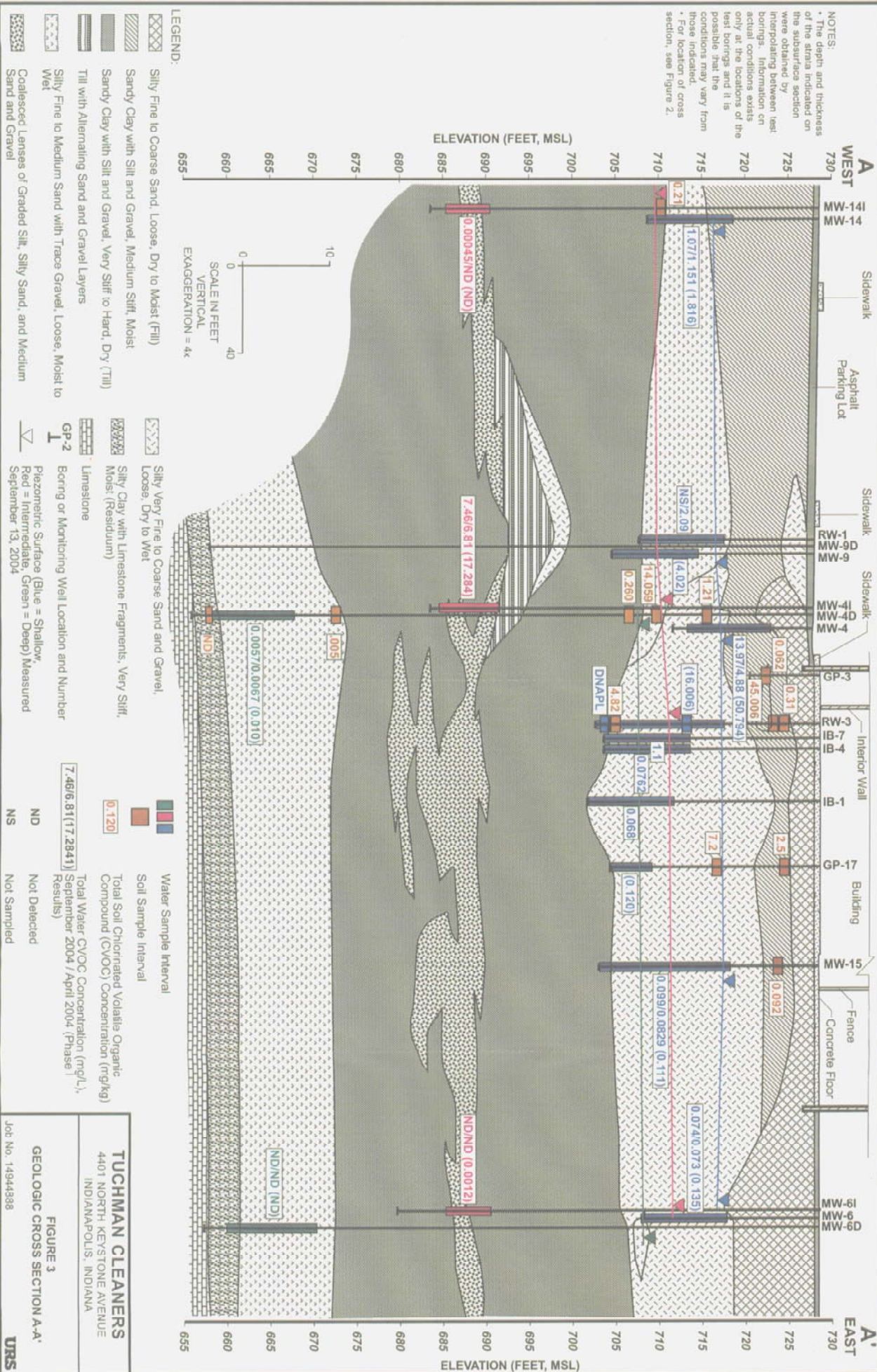


BASE MAP SOURCE: MAGIS Aerial Photography, 2002.

TUCHMAN CLEANERS
4401 NORTH KEYSTONE AVENUE
INDIANAPOLIS, INDIANA

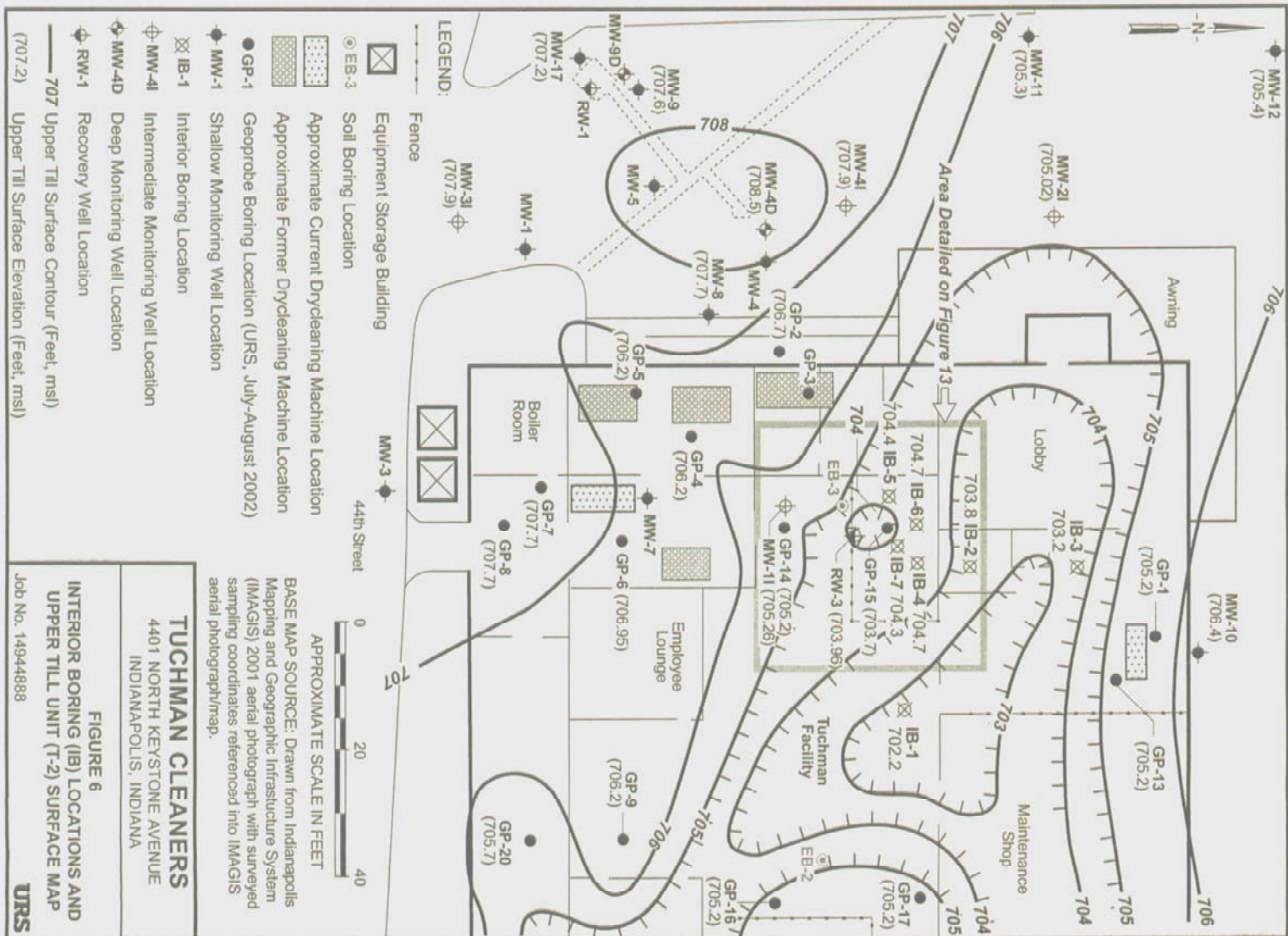
FIGURE 1
SITE VICINITY MAP SHOWING PROBE,
PIEZOMETER, AND WELL LOCATIONS

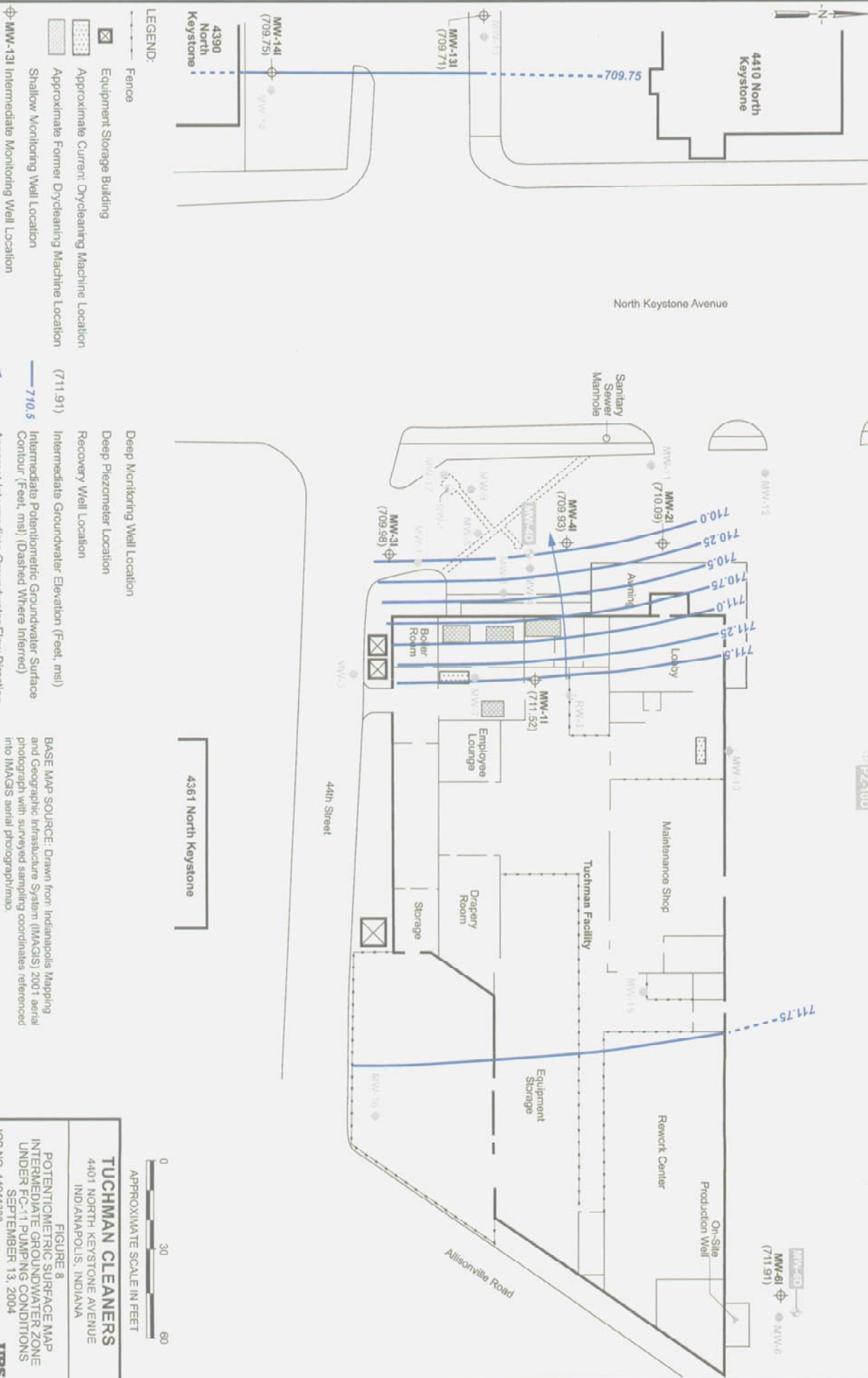


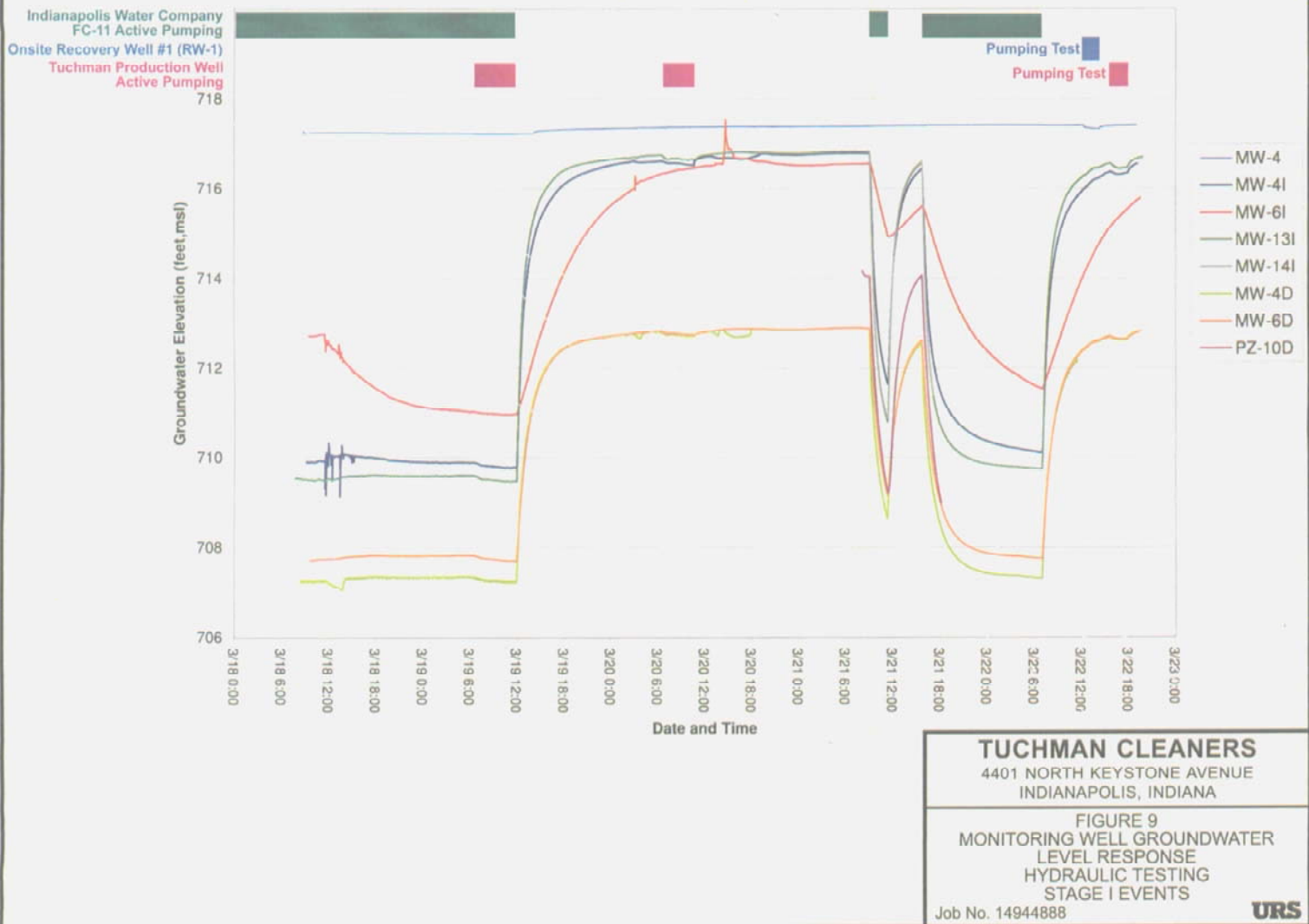


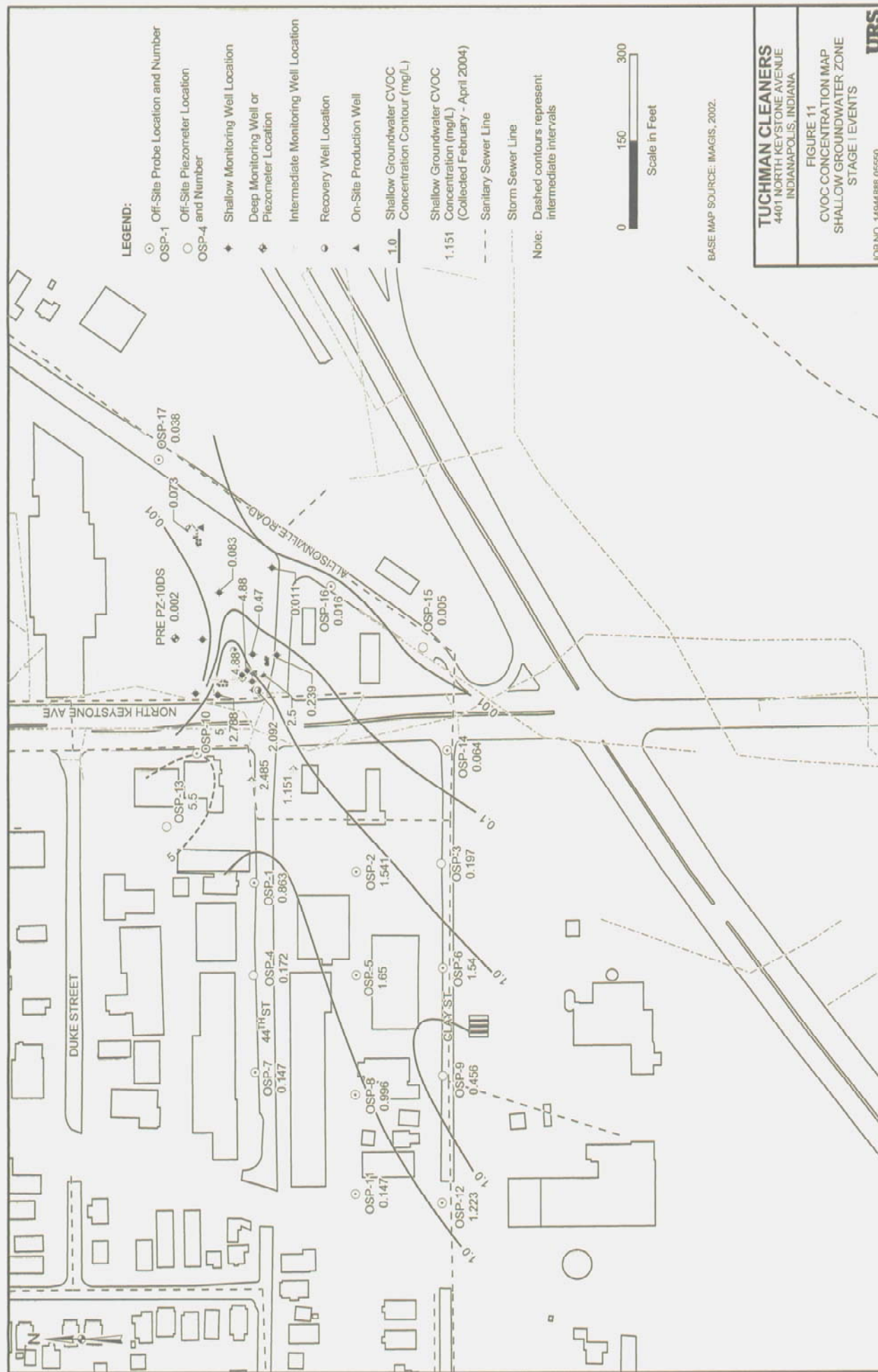


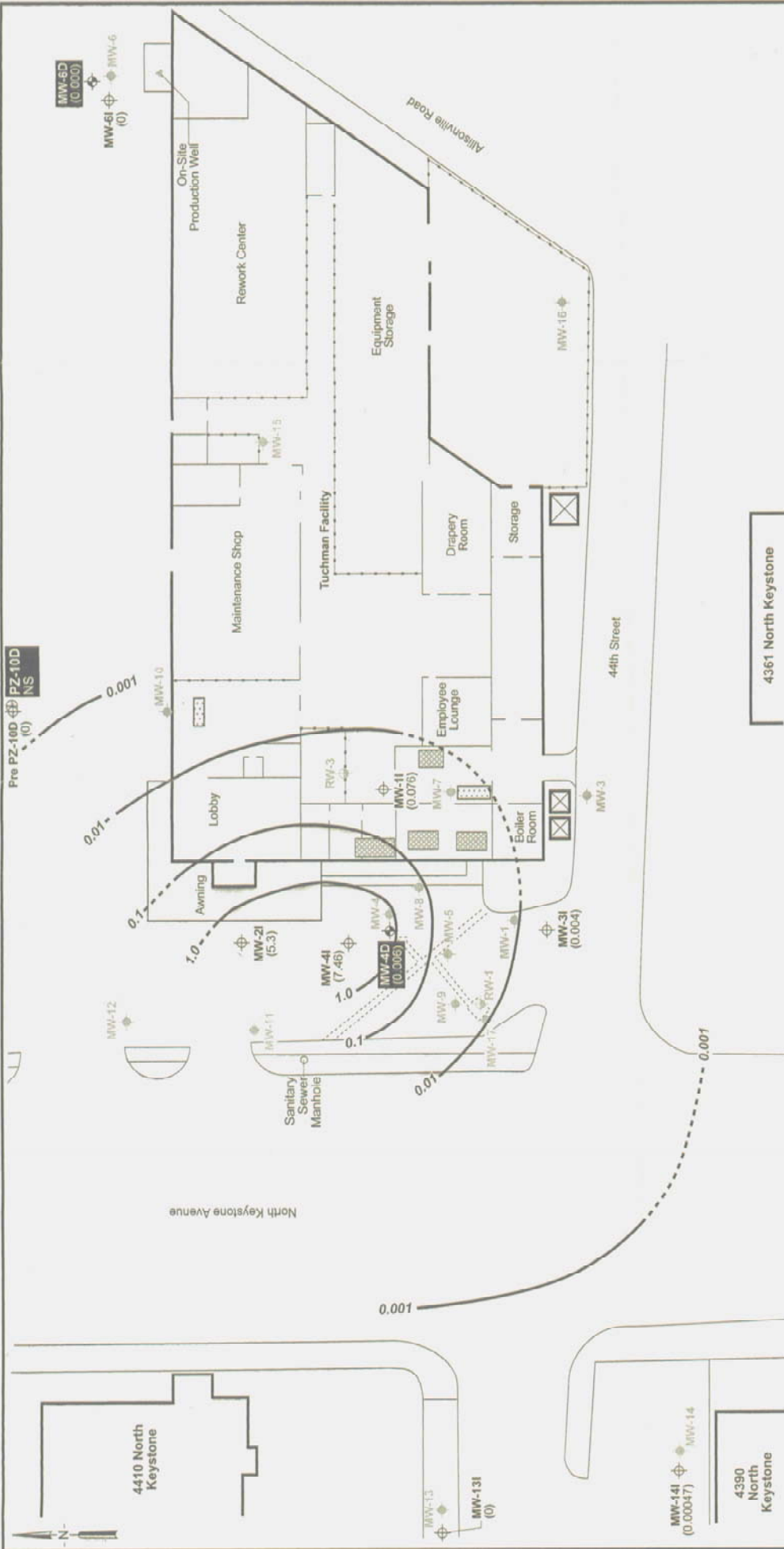
Job No. 14944888











APPROXIMATE SCALE IN FEET

0 30 60

TUCHMAN CLEANERS
4401 NORTH KEYSTONE AVENUE
INDIANAPOLIS, INDIANA

FIGURE 12
CVOC CONCENTRATION MAP
SEPTEMBER 13 AND 14, 2004
INTERMEDIATE AND DEEP
GROUNDWATER ZONE

JOB NO. 1494883

URS

NOTE: Deep groundwater CVOC concentration not used in contouring. Concentrations are listed for information only.

BASE MAP SOURCE: Drawn from Indianapolis Mapping and Geographic Infrastructure System (IMAGIS) 2001 aerial photograph with surveyed sampling coordinates referenced into IMAGIS aerial photograph/map.

MW-6D (0.000) Deep Monitoring Well Location
PZ-10D NS Deep Piezometer Location
RW-3 (0.004) Recovery Well Location
Intermediate Groundwater CVOC Concentration (mg/L)
Intermediate CVOC Concentration Contour (mg/L) (Dashed Where Inferred)

LEGEND:

Equipment Storage Building
Approximate Current Drycleaning Machine Location
Approximate Former Drycleaning Machine Location
Shallow Monitoring Well Location
Intermediate Monitoring Well Location

BASE MAP SOURCE: Drawn from Indianapolis Mapping and Geographic Infrastructure System (IMAGIS) 2001 aerial photograph with surveyed sampling coordinates referenced into IMAGIS aerial photograph/map.

TUCHMAN CLEANERS
4401 NORTH KEYSTONE AVENUE
INDIANAPOLIS, INDIANA

FIGURE 13
PROJECTED DNAPL EXTENT

Job No. 14944888

APPENDIX A
BORING LOGS

DESCRIPTION OF SUBSURFACE MATERIALS

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	
0							ASPHALT
							GRAVEL base
							Brown fine to coarse SAND with gravel, loose, moist
48			N	0	0		
			N	0	0		
5			N	0	0		grades medium without gravel
			N	0	0		grades fine to coarse
83			N	0	0		
			N	0	0		
75			N	0	0		
			N	0	0		Orangish brown silty fine to coarse SAND with gravel, dense
15			N	0	0		Brownish gray fine to coarse SAND with gravel, moist
			N	0	0		grades more brown, wet
100			N	0	0		grades fine to coarse sand and gravel
			N	0	0		
67			N	0	0		
			N	0	0		Gray silty CLAY with gravel, very stiff to hard, moist
25							

Boring terminated at 25 feet bgs on 2/26/04.
 4 foot screen point driven to 24 feet bgs and and protective casing retracted to 20 feet
 bgs to allow groundwater to flow through the screen.
 Groundwater sample collected from disposable tubing with check valve attached at the base of the
 tubing.
 Screen point removed after sampling and boring backfilled with bentonite on 2/26/04.

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
 SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
 NR=No Sample Recovered
 ND=Not Detected
 NS=Not Sampled

URS

JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave. - Stage I Field Activities
 RI - Phase II
 Indianapolis, Indiana

PIEZOMETER
 OSP-1

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS
0							Brown silty CLAY, medium stiff, moist, organic rich near surface
83			N	0	0		
			N	0	0		grades with large limestone gravel
5			N	0	0		Brown silty fine to coarse SAND and GRAVEL, dry, loose
83			N	0	0		
10			N	2.8	0		grades moist
			N	2.0	0		
83			N	4.2	0		
15			N	6.8	0		
93			N	9.4	0		grades without silt, and with more coarse sand, wet
20			N	27.4	0		
			N	5.5	0		grades with silt, moist
100			N	45.2	0		grades with less silt, wet
			N		0		grades to medium sand with less gravel from 22.5 to 23.0 feet bgs
25			N	0	0		grades gray
60			N	0	0		grades with more coarse gravel
			N	0	0		Gray silty CLAY with fine to coarse sand and gravel, very stiff to hard, moist to dry (TILL)
30							

Boring terminated at 30 feet bgs on 2/25/04.
 1 inch diameter PVC temporary piezometer installed to 25 feet bgs with a 5 foot screen.
 Groundwater sample was collected using a disposable polyethylene (PE) bailer.
 Temporary piezometer removed and boring backfilled with bentonite on 2/25/04.

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
 SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
 NR=No Sample Recovered
 ND=Not Detected
 NS=Not Sampled

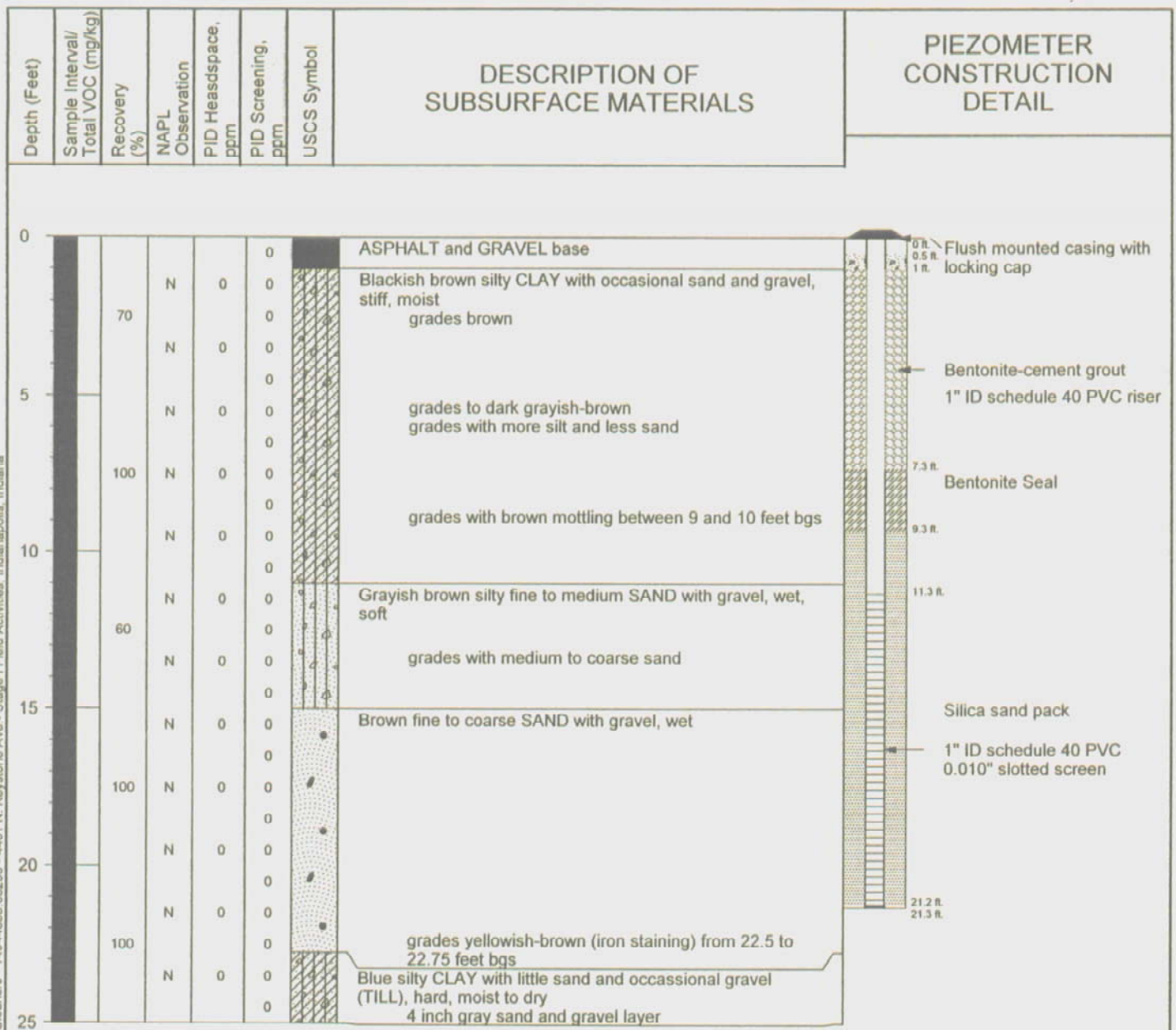
URS

JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave.- Stage I Field Activities
 RI - Phase II
 Indianapolis, Indiana

**PIEZOMETER
OSP-2**



Boring terminated at 25 feet on 2/26/04.
Piezometer installed to 21.3 feet bgs with a 10 foot screen.
Groundwater sample collected using a disposable PE bailer.

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

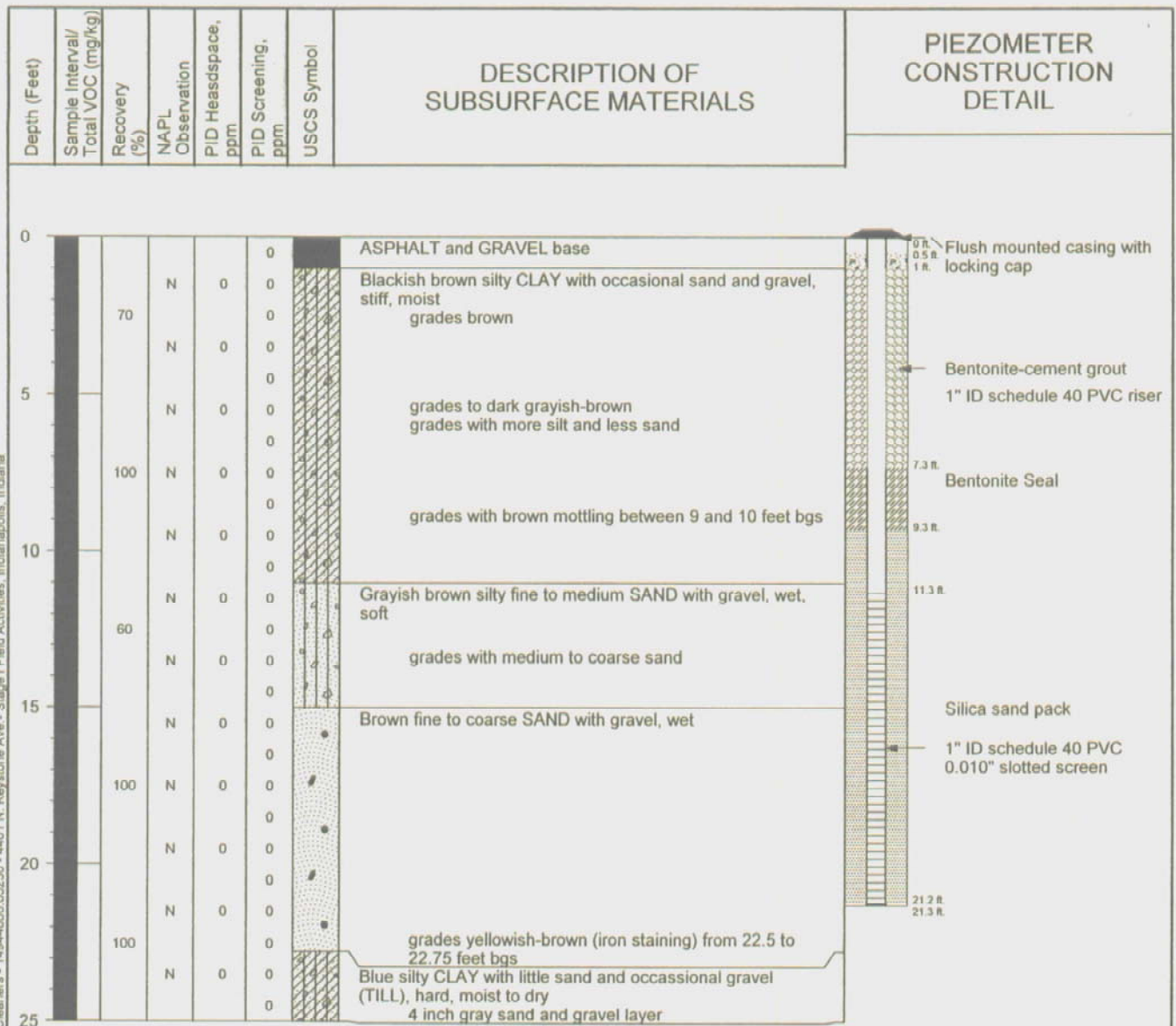
JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave.- Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

PIEZOMETER
OSP-3

Page 1 of 1



Boring terminated at 25 feet on 2/26/04.
Piezometer installed to 21.3 feet bgs with a 10 foot screen.
Groundwater sample collected using a disposable PE bailer.

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

URS

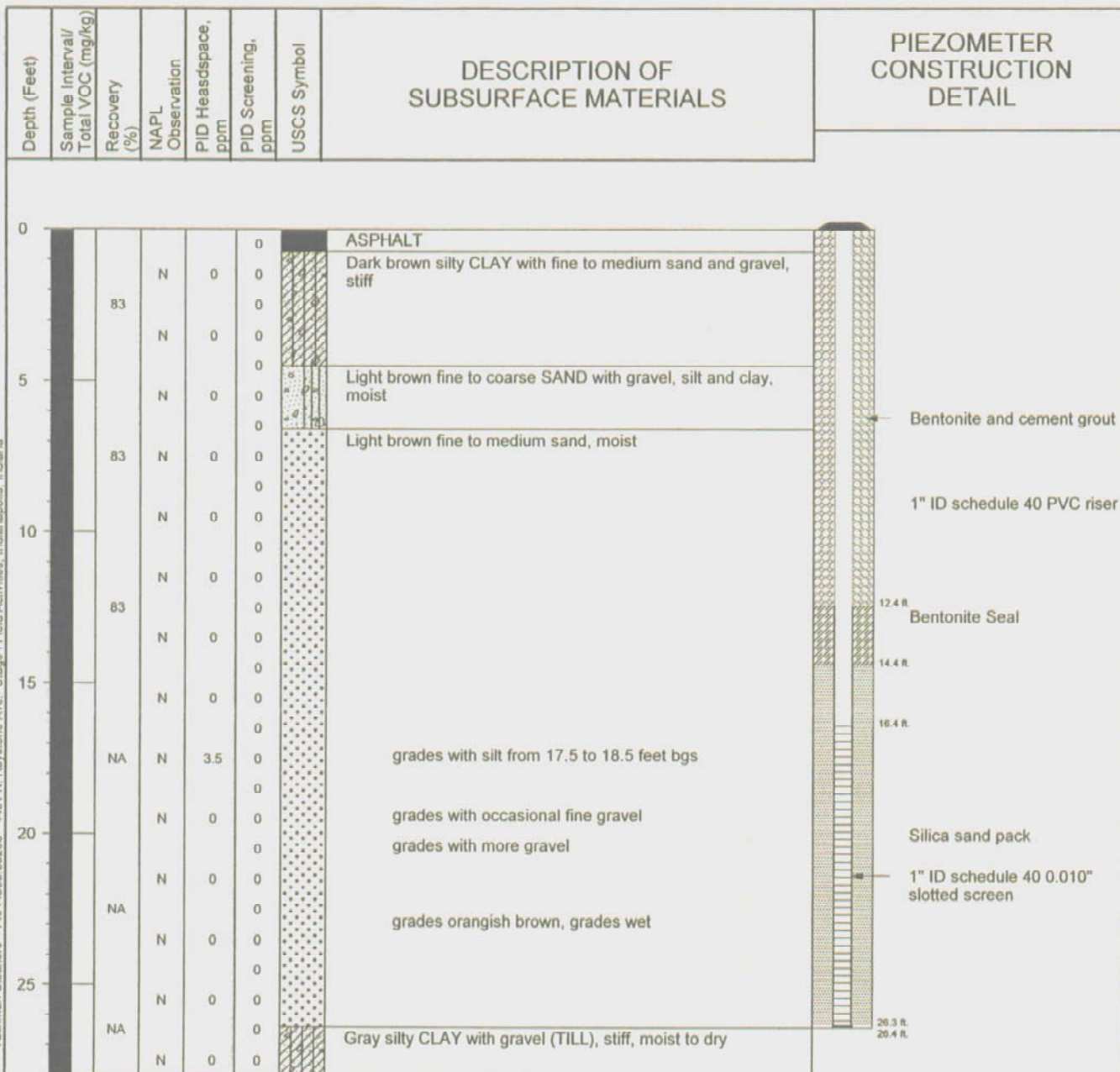
JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave.- Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
OSP-3**

Page 1 of 1



Boring terminated at 28 feet on 2/27/04.
Piezometer installed to 26.4 feet bgs with a 10 foot screen.

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

URS

JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave.- Stage I Field Activities
RI - Phase II
Indianapolis, Indiana


**PIEZOMETER
OSP-4**

Page 1 of 1

Tuchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave. - Stage I Field Activities, Indianapolis, Indiana

TUCHMAN LOG PHASE2 TUCHMAN STAGE I 2004.GPJ 11/23/04

TUCHMAN LOG PHASE2 TUCHMAN STAGE 1 2004.GPJ 11/23/04
Tuchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave.- Stage I Field Activities, Indianapolis, Indiana

DESCRIPTION OF SUBSURFACE MATERIALS						
Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol
0						ASPHALT and GRAVEL base
			N	0	0	Dark brown clayey SILT, moist, soft grades brown, stiff to hard
	58		N	0	0	
			N	0	0	
5			N	0	0	grades with sand
	70		N	3.4	3.5	Brown fine to medium SAND with occasional gravel, loose, moist
			N	15.7	4.2	
10			N	0	0	
	70		N	0	0	
			N	0	0	grades without gravel from 13.5 to 14.5 feet bgs
15			N	0	0	
	87		N	0	0	Brown fine to coarse SAND and GRAVEL, moist, brown
			N	0	0	
20			N	0	0	
	100		N	0	0	
			N	0	0	grades wet
25			N	2.5	0	
	70		N	2.6	0	
			N	0	0	
30			N	0	0	Gray silty CLAY, stiff to hard, moist (TILL)
<p>Boring terminated at 30 feet on 2/26/04. 1 inch ID PVC temporary piezometer installed to 29 feet with a 5 foot screen. Groundwater sample collected using a disposable PE bailer. Temporary piezometer removed and boring backfilled with bentonite on 2/26/04.</p> <p>LEGEND:  Geoprobe Sample N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence SV= Slight Violet fluorescence SW= Slight Whitish fluorescence</p> <p>PID=Photoionization Detector NR=No Sample Recovered ND=Not Detected NS=Not Sampled</p>						
URS JOB NO. 14944888.05250		Tuchman Cleaners 4401 N. Keystone Ave.- Stage I Field Activities RI - Phase II Indianapolis, Indiana			PIEZOMETER OSP-5	
Page 1 of 1						

DESCRIPTION OF SUBSURFACE MATERIALS

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	
0							ASPHALT
							Dark gray silty fine SAND
							Dark brown silty CLAY with fine to coarse sand with gravel, stiff, moist
							Brown medium SAND with occasional gravel, loose, moist
50			N	0	0		
				NR	0		
			N	0	0		
				NR	0		
5			N	0	0		grades with an 1-inch dark gray seam
							grades with an 1-inch light brown sand seam
60			N	0	0		grades with coarse sand
							Brown medium to coarse SAND, loose, moist
							Brown fine to coarse SAND, loose, moist
10			N	0	0		grades with gravel
							grades with silt
75			N	0	0		
15			N	0	0		
100			N	0	0		grades with more gravel
20			N	0	0		
100			N	4.7	0		grades wet with a 4-inch gravel layer
25			N	5.7	0		grades yellowish brown (iron staining)
83			N	12	0		Brown fine to medium SAND, occasional gravel, loose, wet
30			N	7.0	0		grades with silt, medium dense, moist
							grades loose
			N	5	0		
100			N	13.7	0		
35			N	0	0		

URS

JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave.- Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
OSP-6**

Page 1 of 2

TUCHMAN LOG PHASE2 TUCHMAN STAGE 1 2004.GPJ 11/23/04
Tuchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave. - Stage I Field Activities, Indianapolis, Indiana

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS
<div>Gray silty CLAY with occasional gravel (TILL) moist</div> <div>Boring terminated at 35 feet on 2/26/04.</div> <div>1 inch diameter PVC temporary piezometer to 30 feet bgs installed with a 5 foot screen.</div> <div>Groundwater sample collected using a disposable PE bailer.</div> <div>Temporary piezometer removed and boring backfilled with bentonite on 2/26/04.</div>							
<div>LEGEND:</div> <div><div><div></div><div>Geoprobe Sample</div></div><div>N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence</div><div>SV= Slight Violet fluorescence SW= Slight Whitish fluorescence</div><div>PID=Photoionization Detector</div><div>NR=No Sample Recovered</div><div>ND=Not Detected</div><div>NS=Not Sampled</div></div>							
<div>URS</div> <div>JOB NO. 14944888.05250</div>		<div>Tuchman Cleaners</div> <div>4401 N. Keystone Ave.- Stage I Field Activities</div> <div>RI - Phase II</div> <div>Indianapolis, Indiana</div>			<div>PIEZOMETER</div> <div>OSP-6</div> <div>Page 2 of 2</div>		

Tuchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave. - Stage I Field Activities, Indianapolis, Indiana

TUCHMAN LOG PHASE2 TUCHMAN STAGE 1 2004 GPJ 11/23/04

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS
0							ASPHALT and GRAVEL base
			N	0	0		Brown clayey SILT, soft, moist
	80						grades with occasional sand
			N	0	0		grades with more clay, stiff
5			N	0/1.7*	0		grades medium stiff
	53		N	0	0		
			N	0	0		Brown fine to medium SAND with occasional coarse sand and gravel, moist
10			N	0	0		
	80		N	0	0		Brown fine to medium SAND, moist
			N	0	0		grades fine
15			N	0	0		
	67		N	0	0		
20			N	0	0		
	77		N	0/14.9*	0		
			N	0/10.1*	0		Brown fine to medium SAND with gravel, wet
25			N	0/22.6*	0		grades orangish-brown (iron staining) from 24.5 to 25.8 feet bgs
	100		N	0/21.4*	0		grades with more coarse sand and gravel
			N	0/58.4*	0		Bluish gray silty CLAY with occasional sand and gravel, stiff, moist
30							

LEGEND:

 Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

Boring terminated at 30 feet on 4/8/04.
1 inch PVC temporary piezometer installed to 30 feet bgs with a 5 foot screen.
Groundwater sample collected using a disposable PE bailer.
Temporary piezometer removed and boring backfilled with bentonite on 4/8/04.
*PID headspace measurements include an initial response and the peak of a delayed response observed from the headspace container (delay response is likely the result of moisture).
PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

URS

JOB NO. 14944888.05250


Tuchman Cleaners

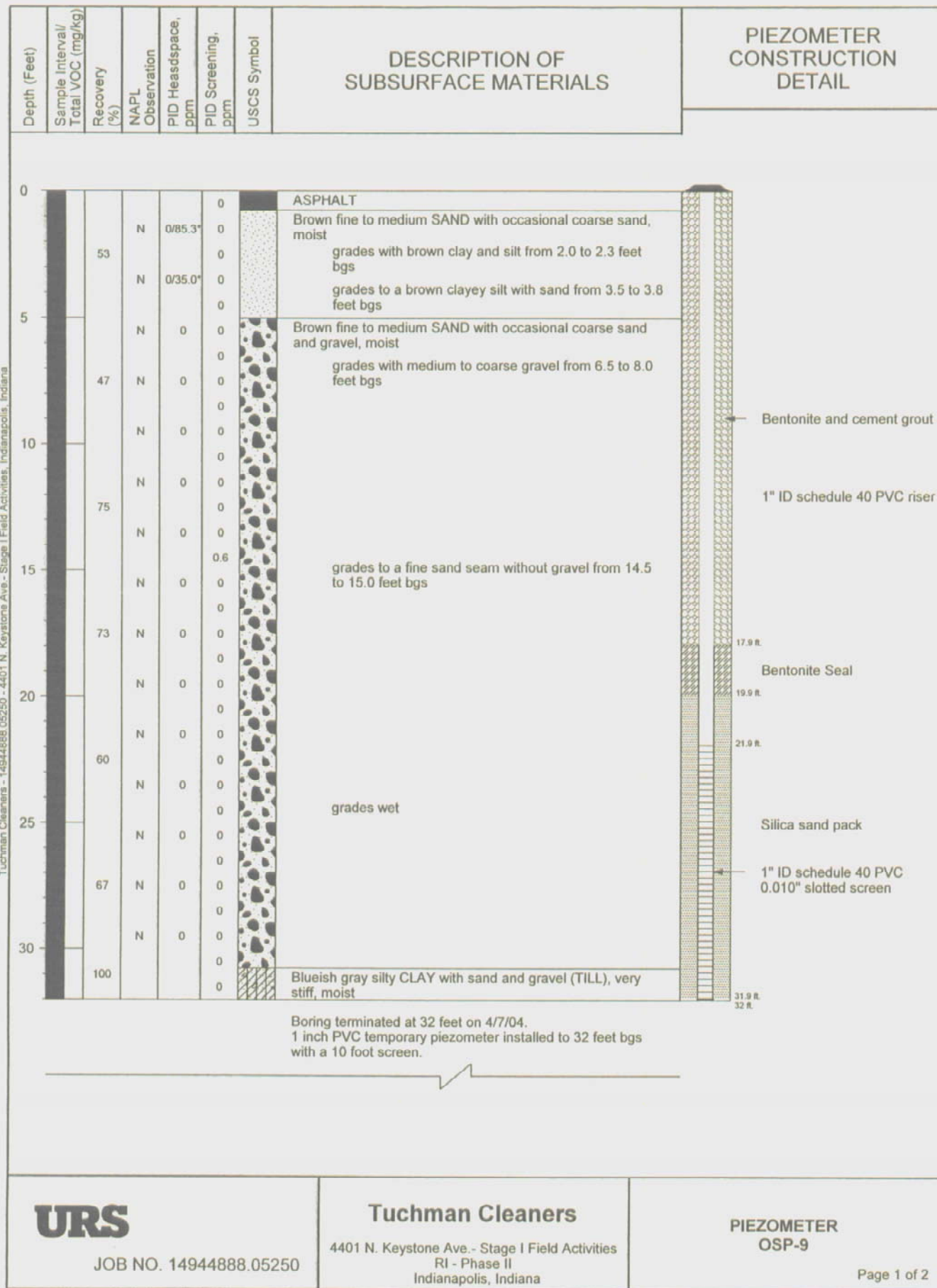
4401 N. Keystone Ave.- Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
OSP-7**

Tuchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave. - Stage I Field Activities, Indianapolis, Indiana

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS
0							ASPHALT and GRAVEL base
							Brown silty CLAY, stiff, moist
	83		N	0/35.6*			
			N	0/34.1*			
5							Light brown fine to medium SAND with occasional coarse sand and gravel, loose, dry to moist
			N	0/7.9*			
	80						
			N	0			
10			N	0			
	77		N	0			
			N	0			
15			N	0			
	80		N	0			
			N	0			
20			N	0			
	60		N	0/1.8*			grades wet
25							Brown coarse SAND with gravel and medium sand, wet
			N	0/4.6*			
	60						grades orangish brown (iron-staining)
							Gray fine to medium SAND with fine gravel and occasional coarse sand, wet
30			N	0			
	100						Bluish gray silty CLAY with occasional gravel, moist, very stiff
Boring terminated at 32 feet on 4/8/04. 1 inch PVC temporary piezometer installed to 32 feet bgs with a 5 foot screen. Groundwater sample collected using a disposable PE bailer. Temporary piezometer removed and boring backfilled with bentonite on 4/8/04.							
URS JOB NO. 14944888.05250		Tuchman Cleaners 4401 N. Keystone Ave. - Stage I Field Activities RI - Phase II Indianapolis, Indiana			PIEZOMETER OSP-8 Page 1 of 2		

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS
<p>*PID headspace measurements include an initial response and the peak of a delayed response observed from the headspace container (delay response is likely the result of moisture).</p>							
<p>LEGEND:</p> <p> Geoprobe Sample</p> <p>N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence SV= Slight Violet fluorescence SW= Slight Whitish fluorescence</p> <p>PID=Photoionization Detector NR=No Sample Recovered ND=Not Detected NS=Not Sampled</p>							
<p>URS</p> <p>JOB NO. 14944888.05250</p>			<p>Tuchman Cleaners</p> <p>4401 N. Keystone Ave.- Stage I Field Activities RI - Phase II Indianapolis, Indiana</p>			<p>PIEZOMETER OSP-8</p>	



Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS	PIEZOMETER CONSTRUCTION DETAIL
<p>Groundwater sample collected using a disposable PE bailer. *PID headspace measurements include an initial response and the peak of a delayed response observed from the headspace container (delay response is likely the result of moisture).</p>								
<p>LEGEND:</p> <p> Geoprobe Sample</p> <p>N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence SV= Slight Violet fluorescence SW= Slight Whitish fluorescence</p> <p>PID=Photoionization Detector NR=No Sample Recovered ND=Not Detected NS=Not Sampled</p>								
URS JOB NO. 14944888.05250			Tuchman Cleaners 4401 N. Keystone Ave.- Stage I Field Activities RI - Phase II Indianapolis, Indiana			PIEZOMETER OSP-9		

Tuchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave. - Stage I Field Activities, Indianapolis, Indiana

TUCHMAN LOG PHASE2 TUCHMAN STAGE 1 2004.GPJ 11/23/04

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS
0							CONCRETE and GRAVEL base
							Brown clayey SILT with occasional sand and fine gravel, moist, soft to medium stiff
40			N	0	0		
			N	0	0		
5			N	0	0		
			N	0	0		
60			N	0	0		
			N	0	0		
10			N	0	0		grades with fine sand
			N	0	0		Brown fine to coarse SAND with silt and gravel, moist
			N	0	0		grades orangeish-brown (iron staining) from 10.2 to 10.4 feet bgs
			N	0	0		grades wet
65			N	0	0		
			N	0	0		
15			N	0	0		grades without fine sand and silt from 14.5 to 15.5 feet bgs
			N	0	0		
65			N	0	0		
			N	0	0		grades gray
20			N	0	0		Bluish gray silty CLAY
			N	50.1/52.3*	2.9		
100			N		59.1		Brown medium SAND with occasional sand and gravel, loose, wet
			N	237	58.2		
100			N		19.0		
25							Bluish gray silty CLAY with fine to coarse sand and gravel (TILL), very stiff, moist to dry

Boring terminated at 25 feet on 4/8/04.
 1 inch PVC temporary piezometer installed to 25 feet bgs with a 5 foot screen.
 Groundwater sample collected using a disposable PE bailer.
 Temporary piezometer removed and boring backfilled with bentonite on 4/8/04.
 *PID headspace measurements include an initial response and the peak of a delayed response
 observed from the headspace container (delay response is likely the result of moisture).

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
 SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
 NR=No Sample Recovered
 ND=Not Detected
 NS=Not Sampled

URS

JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave.- Stage I Field Activities
 RI - Phase II
 Indianapolis, Indiana

**PIEZOMETER
OSP-10**

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS
0	ND	50	N	0	0	ASPHALT	Brown clayey SILT with occasional sand and gravel, medium stiff to stiff, moist
5			N	0	0		Brown fine to coarse SAND with gravel, silt, and clay, moist
			N	0	0		Brown fine to medium SAND with occasional fine gravel, moist
75			N	0	0		
90			N	0	0		
10			N	0	0		
15			N	0	0		grades with silt from 13.5 to 15.5 feet bgs
80			N	0	0		
20			N	0	0		
80			N	0	0		
25			N	0	0		grades with coarse sand
			N	0	0		grades wet
61			N	0	0		
30			N	0	0		
46			N	0	0		without coarse sand
100			N	0	0		Blue gray silty CLAY with occasional sand to fine gravel (TILL), stiff, moist

Luchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave - Stage I Field Activities, Indianapolis, Indiana

URS

JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave.- Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

PIEZOMETER OSP-11

Page 1 of 2

TUCHMAN LOG PHASE2 TUCHMAN STAGE 1 2004 GPJ 11/23/04 TUCHMAN Cleaners - 14944888 05250 - 4401 N. Keystone Ave. - Stage I Field Activities, Indianapolis, Indiana

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS
--------------	---------------------------------------	-----------------	---------------------	-----------------------	-----------------------	-------------	--

Boring terminated at 34 feet on 4/7/04.
1 inch PVC temporary piezometer installed to 34 feet bgs with a 5 foot screen.
Groundwater sample collected using a disposable PE bailer.
Temporary piezometer removed and boring backfilled with bentonite on 4/7/04.

LEGEND:

 Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

URS

JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave.- Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
OSP-11**

							DESCRIPTION OF SUBSURFACE MATERIALS	
Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol		
0							ASPHALT	
							Brown fine to medium SAND with silt, organics, moist	
	27		N	0	0		Brown silty CLAY with sand	
							3 inches of recovery due to fragment of concrete or rock	
5								
	5							
10							Brown fine to coarse SAND with gravel, moist	
	68		N	0/38.9*	0			
			N	0/30.1*	0			
15			N	0/15.1*	0			
	70		N	0/16.9*	0			
20			N	1.8/26.3*	0		grades orangish-brown (iron staining) from 19.0 to 20.0 feet bgs	
	72		N	0/20.3*	0			
			N	0/20.5*	0		grades orangish-brown (iron staining) from 24.0 to 25.0 feet bgs	
25			N	0/8.8*	0			
	83		N	2.1/11.1*	0		Gray SILT, pliable, soft, wet	
			N	0/15.4*	0		grades brown with fine sand and gravel	
30							Brown medium SAND, wet	
			N	0/27.2*	0		grades with gravel	
	100						grades gray with coarse sand	
			N	0/15.8*	0		Bluish gray silty CLAY with occasional sand and gravel (TILL), hard, moist	
35								

URS

JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave. - Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

PIEZOMETER
OSP-12

Page 1 of 2

DESCRIPTION OF
SUBSURFACE MATERIALS

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol
--------------	---------------------------------------	-----------------	---------------------	-----------------------	-----------------------	-------------

Boring terminated at 35 feet on 4/7/04.
1 inch ID PVC temporary piezometer installed to 35 feet bgs with 5 foot screen.
Groundwater sample collected using a disposable PE bailer.
Temporary piezometer removed and boring backfilled with bentonite on 4/7/04.
*PID headspace measurements include an initial response and the peak of a delayed response
observed from the headspace container (delay response is likely the result of moisture).

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

URS

JOB NO. 14944888.05250

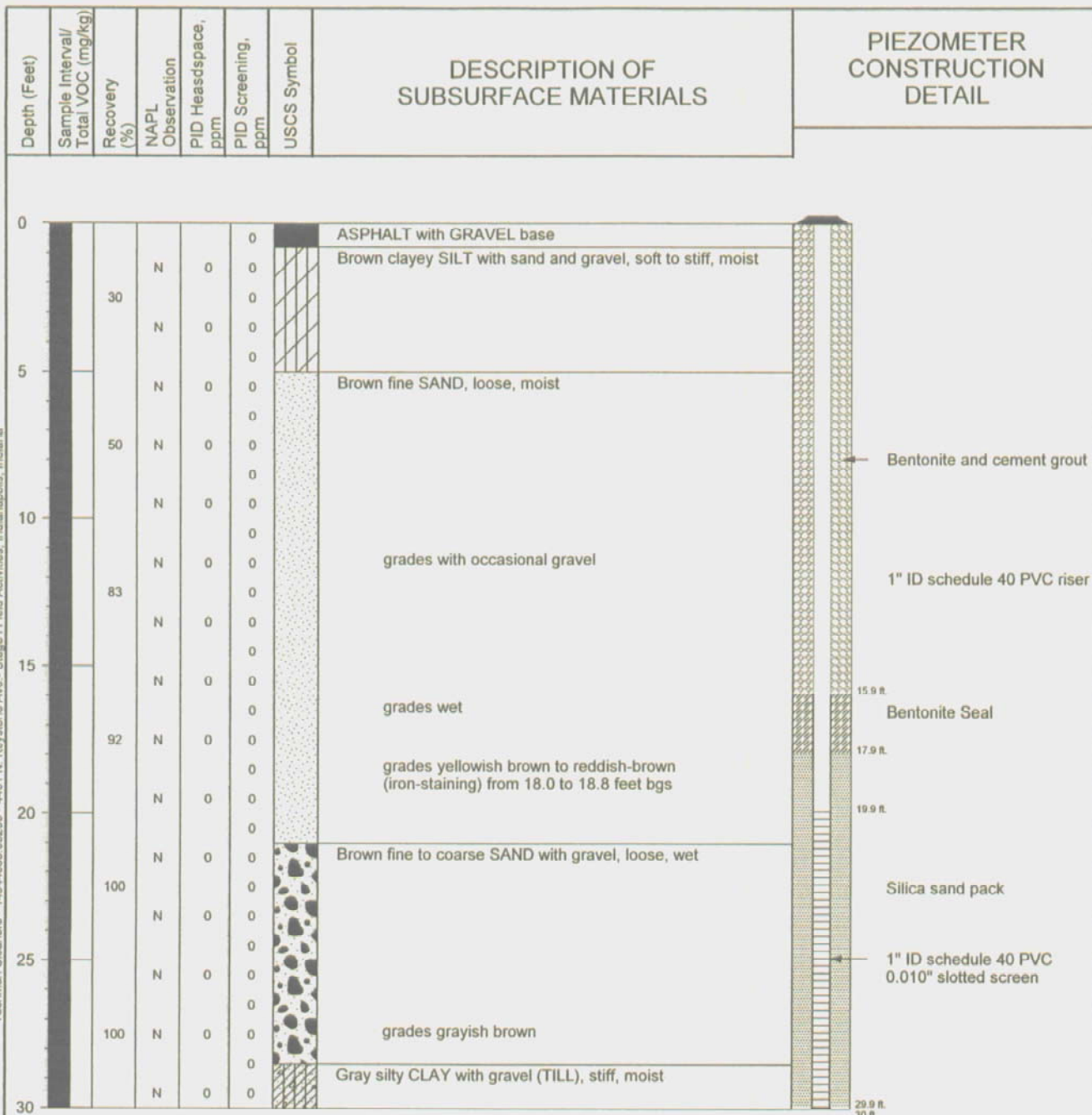
Tuchman Cleaners

4401 N. Keystone Ave.- Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
OSP-12**

Tuchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave. - Stage I Field Activities, Indianapolis, Indiana

TUCHMAN LOG PHASE2 TUCHMAN STAGE 1 2004.GPJ 11/23/04



Boring terminated at 30 feet on 2/27/04.
Piezometer installed to 30 feet bgs with a 10 foot screen.
Groundwater sample collected using a disposable PE bailer.

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

URS

JOB NO. 14944888.05250

Tuchman Cleaners

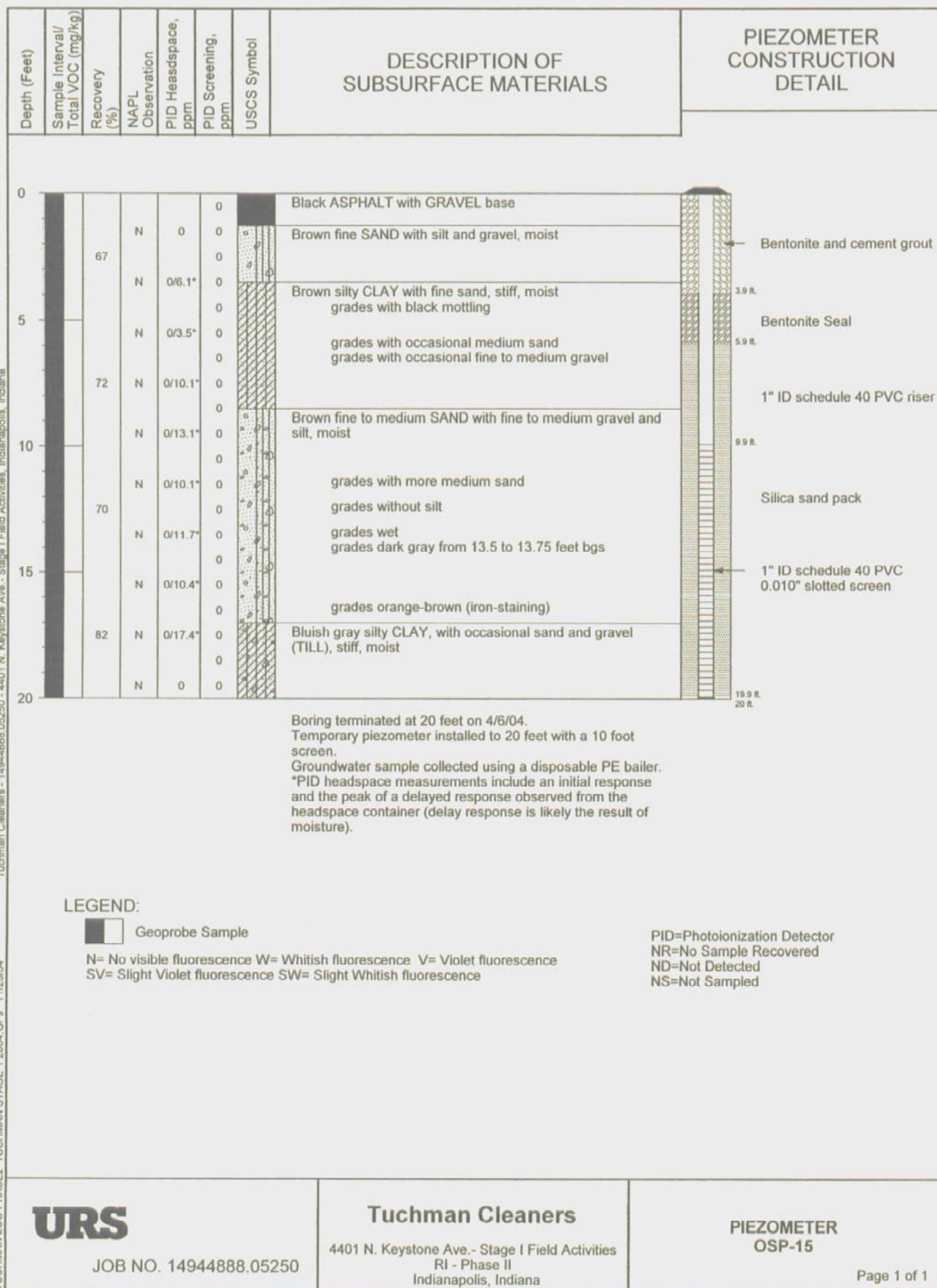
4401 N. Keystone Ave.- Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
OSP-13**

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS
0					5.2		ASPHALT and base
100			N	7.6/51.6	0		
5			N	0/21.3	0		Brown clayey SILT with occasional sand and gravel, stiff, moist grades gray with brown mottling
97			N	0	0		grades with more fine to medium sand
10			N	0	0		Brown fine to medium SAND with silt, clay, gravel grades without clay and trace gravel
50			N	0	0		grades without silt grades wet
15			N	0	0		grades dark gray from 14.0 to 14.5 feet bgs
70			N	2.0/7.5	0		grades with silt from 16.0 to 16.5 feet bgs
20			N	4.0/20.9	0		grades brown
83			N	0	0		Bluish gray silty CLAY with occasional sand and gravel (TILL), very stiff, moist
<p>Boring terminated at 23 feet on 4/8/04. 1 inch ID PVC temporary piezometer installed to 23 feet bgs with a 5 foot screen. Groundwater sample collected using a disposable PE bailer. Temporary piezometer removed and boring backfilled with bentonite on 4/8/04. *PID headspace measurements include an initial response and the peak of a delayed response observed from the headspace container (delay response is likely the result of moisture).</p>							
<p>LEGEND:</p> <div> <div></div> Geoprobe Sample </div> <div> N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence SV= Slight Violet fluorescence SW= Slight Whitish fluorescence </div> <div> PID=Photoionization Detector NR=No Sample Recovered ND=Not Detected NS=Not Sampled </div>							
URS JOB NO. 14944888.05250		Tuchman Cleaners 4401 N. Keystone Ave. - Stage I Field Activities RI - Phase II Indianapolis, Indiana			PIEZOMETER OSP-14 Page 1 of 1		

Tuchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave. - Stage I Field Activities, Indianapolis, Indiana

TUCHMAN LOG PHASE2 TUCHMAN STAGE I 2004.GPJ 11/23/04



Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS
0							ASPHALT and GRAVEL base
0			N	0/87.9*	0		Grayish brown silty CLAY with occasional sand and gravel, medium stiff, moist
0	87	ND	N	0/91.7*	0		grades dark brown
5			N	0/49.7*	0		grades soft
5			N	0/55.4*	0		grades with coarse sand
10			N	0/97.4*	0		Brown fine to medium SAND with fine gravel, moist to wet.
10			N	0/194*	0		grades wet
10	57		N	0/116*	0		Brown fine to medium GRAVEL with fine sand and silt, wet
15			N	0/92.4*	0		Brownish gray fine to medium SAND with occasional gravel, wet
15			N	0/50.5*	0		grades without gravel
20			N	0/78.2*	0		grades with medium to coarse sand
20	100		N	0/57.0*	0		grades with fine to medium gravel
20			N				Bluish gray silty CLAY with occasional gravel and sand (TILL), stiff, moist

Boring terminated at 21.5 feet on 4/6/04.

1 inch PVC temporary piezometer installed to 21.5 feet bgs with a 5 foot screen.

Groundwater sample collected using a disposable PE bailer.

Temporary piezometer removed and boring backfilled with bentonite on 4/6/04.

*PID headspace measurements include an initial response and the peak of a delayed response observed from the headspace container (delay response is likely the result of moisture).

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

URS

JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave.- Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
OSP-16**

Page 1 of 1

DESCRIPTION OF SUBSURFACE MATERIALS

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	
0						NR	ASPHALT and CONCRETE
10							Brown silty CLAY with occasional coarse sand with gravel, stiff, moist
5							
85			N	0	0		Brown to tan fine to coarse SAND and GRAVEL, dry to moist
10			N	0/2.6*	0		
60			N	0/10.4*	0		
15			N	0/396*	0		grades wet
			N	0/128*	0		grades with less gravel
67			N	0/40*	0		grades with occasional gravel
20			N	0/19.7*	0		
33			N	0	0		
			N	0	0		Bluish gray CLAY with fine to medium sand and gravel (TILL), stiff, moist

Boring terminated at 24 feet on 4/6/04.
1 inch PVC temporary piezometer installed to 24 feet bgs with a 5 foot screen.
Groundwater sample collected using a disposable PE bailer.
Temporary piezometer removed and boring backfilled with bentonite on 4/6/04.
*PID headspace measurements include an initial response and the peak of a delayed response observed from the headspace container (delay response is likely the result of moisture).

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

URS

JOB NO. 14944888.05250

Tuchman Cleaners

4401 N. Keystone Ave. - Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
OSP-17**

Page 1 of 1

DESCRIPTION OF SUBSURFACE MATERIALS

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	
0							ASPHALT Dark gray silty CLAY with asphalt (weathered), stiff, moist
	67			0	0		grades gray
5				0	0		
	100			0	0		Dark grayish brown silty CLAY with fine to coarse sand and gravel, very stiff, moist
10				0	0		
	100			0	0		Brown fine to coarse SAND and GRAVEL, loose, wet (shallow groundwater zone)
				0	0		grades dense
15				0	0		
				0	0		Dark brownish gray silty CLAY with trace fine to coarse sand and gravel, medium stiff, moist
20				0	0		
	100			0	0		Brown fine to coarse SAND and fine to coarse GRAVEL with trace silt, loose, wet
25				0	0		
	100			0	0		grades without coarse gravel
30				0	0		
				0	0		Gray silty CLAY with fine to coarse gravel, hard, dry (Till T-2)

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

Boring terminated at 30 feet on 2/27/04.
4 foot screen point driven to 30 feet and protective casing retracted for a groundwater sample from the shallow aquifer.
4 foot screen point driven to 50 feet and protective casing retracted for a groundwater sample from the intermediate aquifer.
Screen point removed after sampling and boring backfilled with bentonite on 2/27/04.
PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

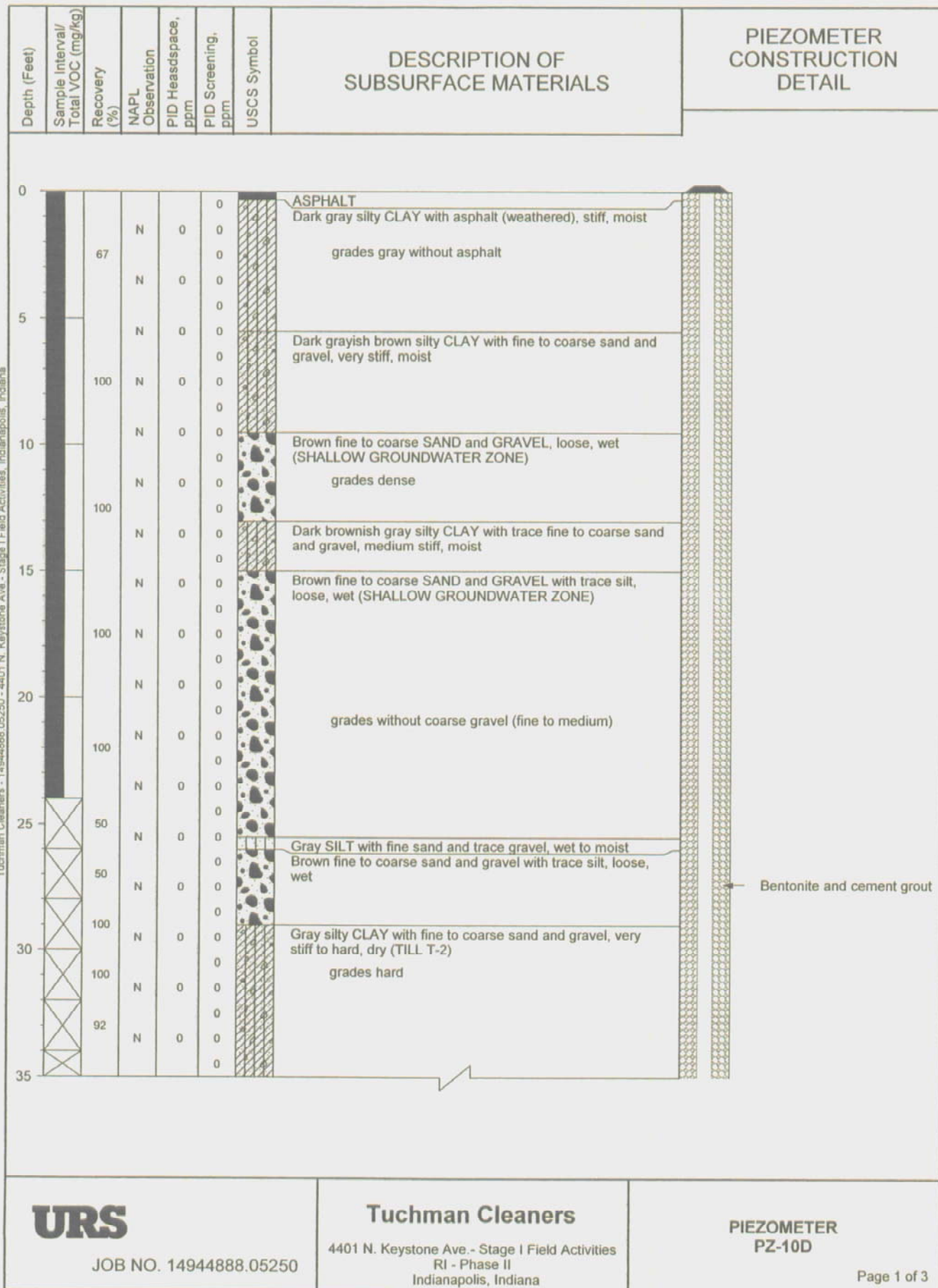
URS

JOB NO. 14944888.05250

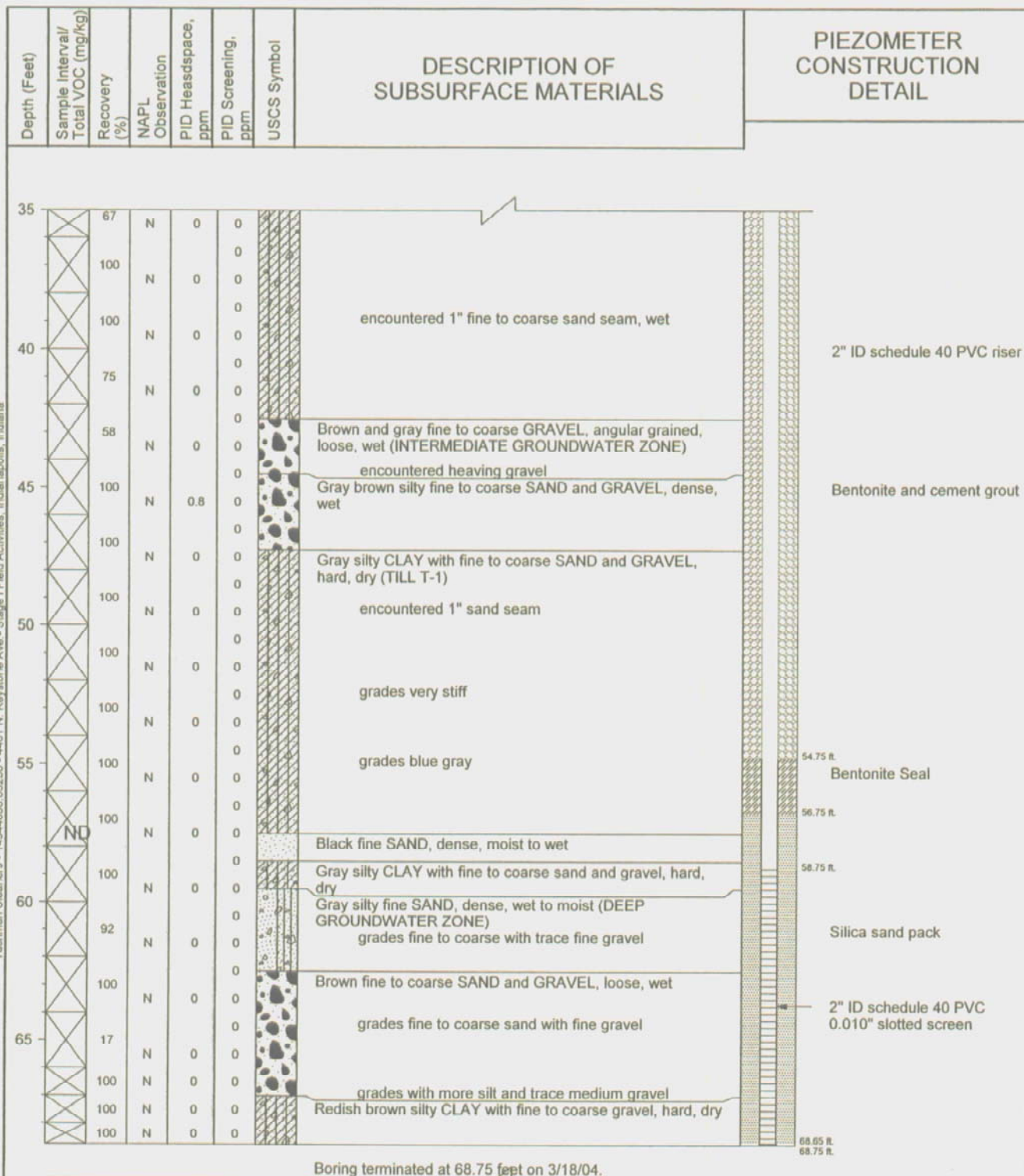
Tuchman Cleaners

4401 N. Keystone Ave. - Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
PrePZ-10D**



Tuchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave. - Stage I Field Activities, Indianapolis, Indiana



URS



JOB NO. 14944888.05250

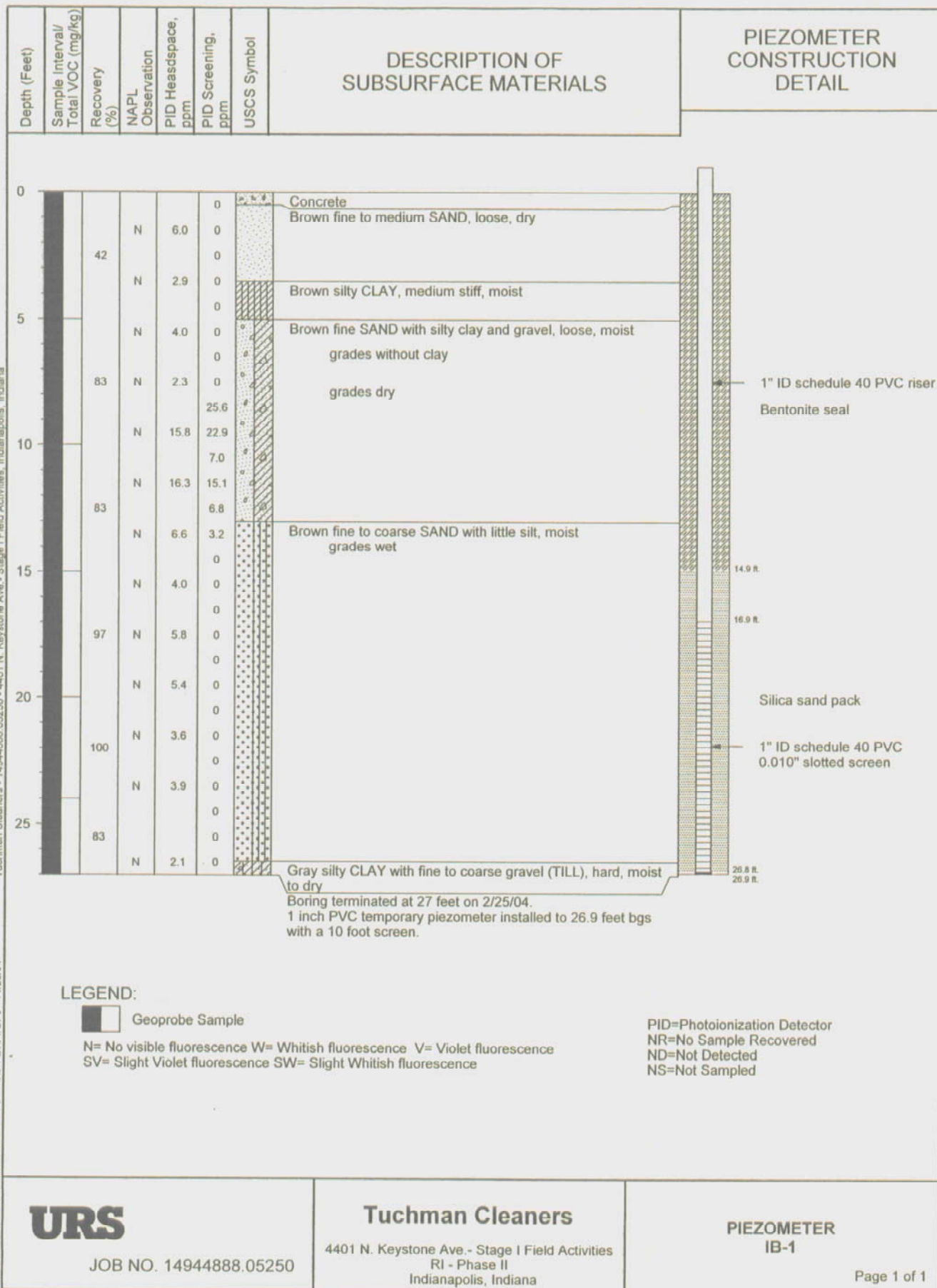
Tuchman Cleaners

4401 N. Keystone Ave. - Stage I Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
PZ-10D**

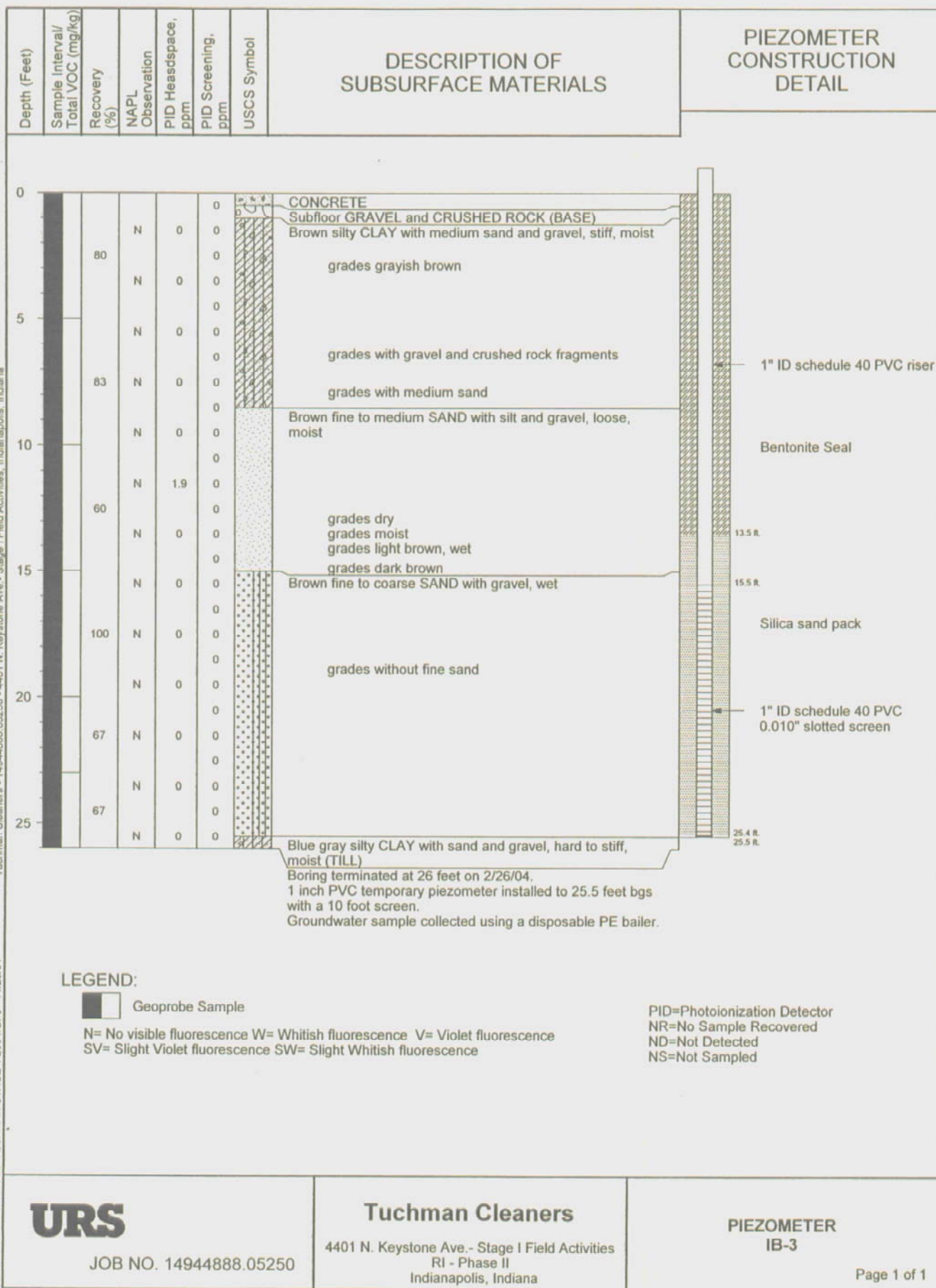
Page 2 of 3

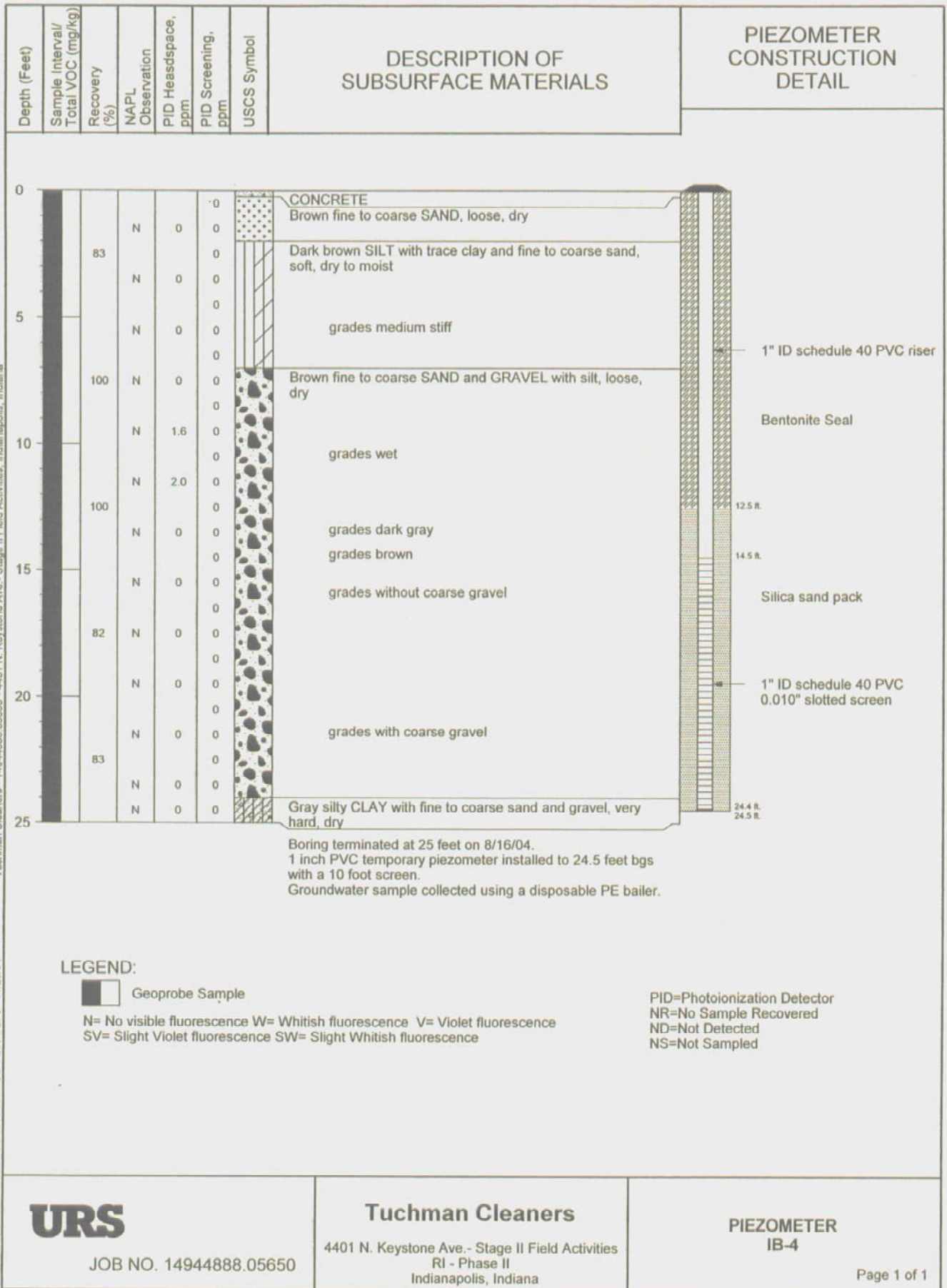
Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS	PIEZOMETER CONSTRUCTION DETAIL
<p>(auger refusal on bedrock surface). 2 inch PVC piezometer installed to 68.75 feet with 10 foot screen on 3/18/04 and 3/19/04.</p>								
<p>LEGEND:</p> <p> Geoprobe Sample  Split Spoon</p> <p>N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence SV= Slight Violet fluorescence SW= Slight Whitish fluorescence</p> <p>PID=Photoionization Detector NR=No Sample Recovered ND=Not Detected NS=Not Sampled</p>								
URS JOB NO. 14944888.05250				Tuchman Cleaners 4401 N. Keystone Ave.- Stage I Field Activities RI - Phase II Indianapolis, Indiana			PIEZOMETER PZ-10D Page 3 of 3	



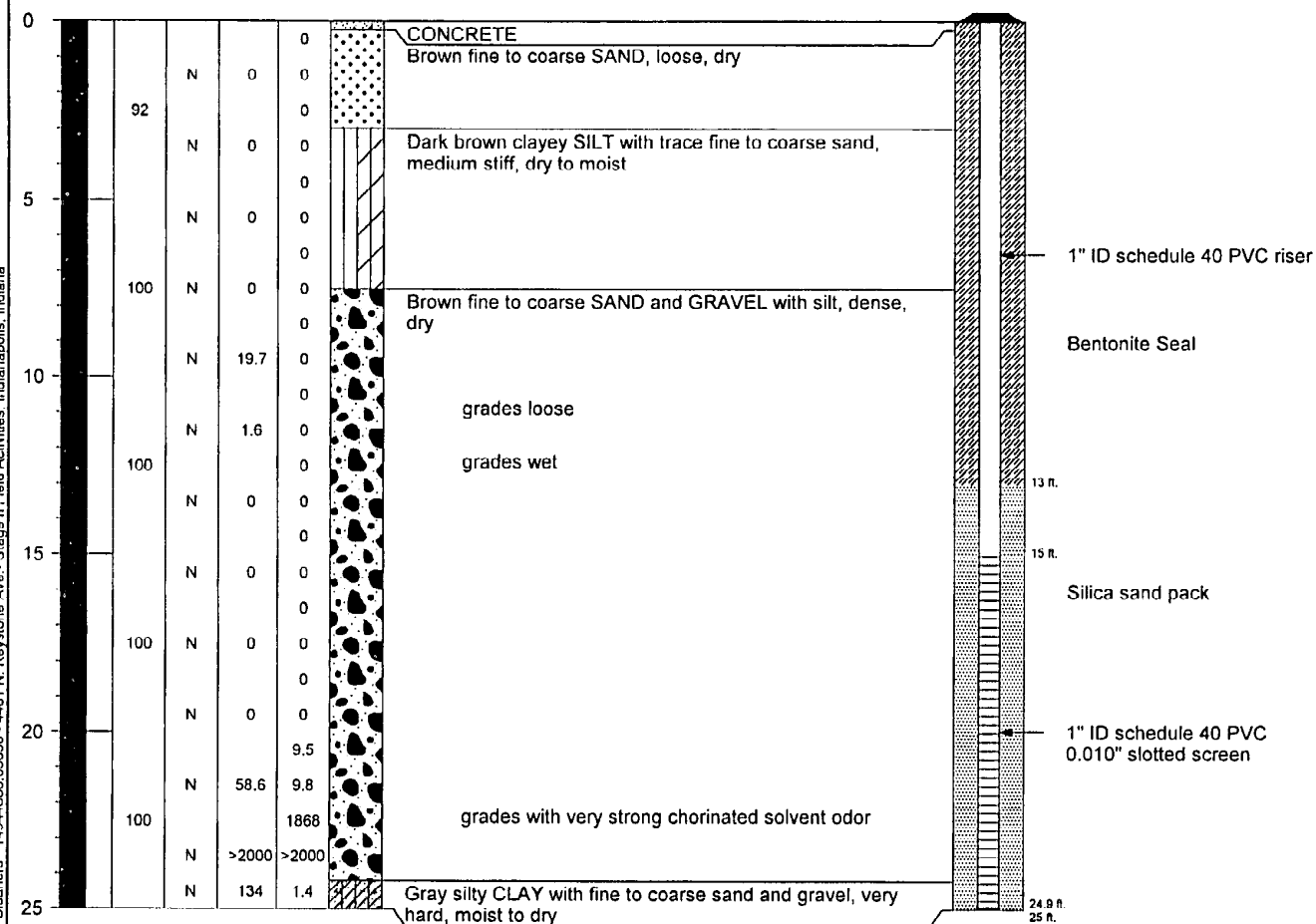
Tuchman Cleaners - 14944888.05250 - 4401 N. Keystone Ave. - Stage I Field Activities, Indianapolis, Indiana

TUCHMAN LOG PHASE2 TUCHMAN STAGE 1 2004 GPJ 11/23/04





Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS	PIEZOMETER CONSTRUCTION DETAIL
--------------	---------------------------------------	-----------------	---------------------	-----------------------	-----------------------	-------------	--	--------------------------------------



Tuchman Cleaners - 14944888.05650 - 4401 N. Keystone Ave. - Stage II Field Activities Indianapolis, Indiana

TUCHMAN LOG PHASE2 TUCHMAN STAGE II 2004.GPJ 11/23/04

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

URS

JOB NO. 14944888.05650

Tuchman Cleaners

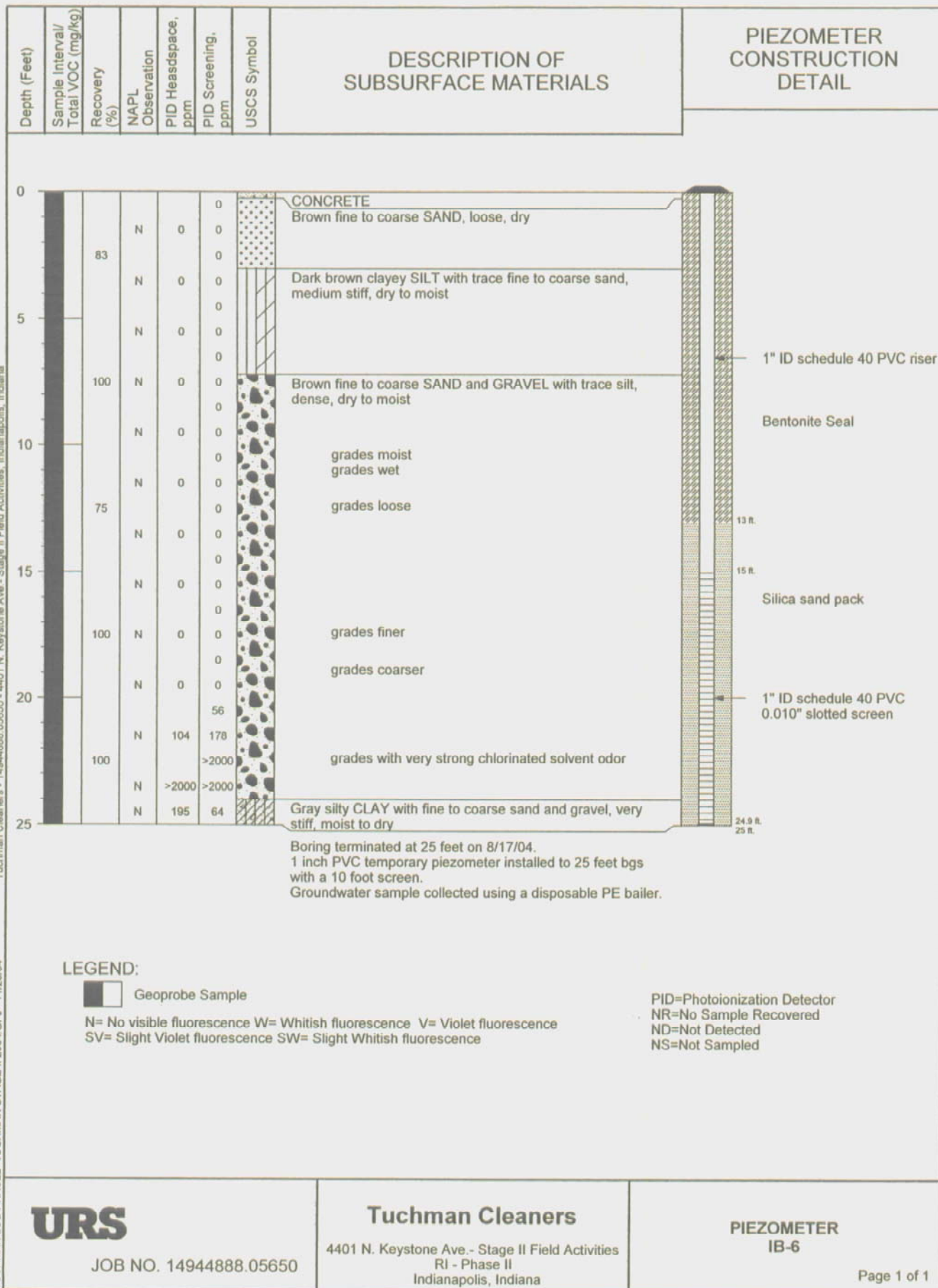
4401 N. Keystone Ave.- Stage II Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
IB-5**

Page 1 of 1

Tuchman Cleaners - 14944888.05650 - 4401 N. Keystone Ave. - Stage II Field Activities, Indianapolis, Indiana

TUCHMAN LOG PHASE2 TUCHMAN STAGE II 2004 GPJ 11/23/04



LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
NR=No Sample Recovered
ND=Not Detected
NS=Not Sampled

URS

JOB NO. 14944888.05650

Tuchman Cleaners

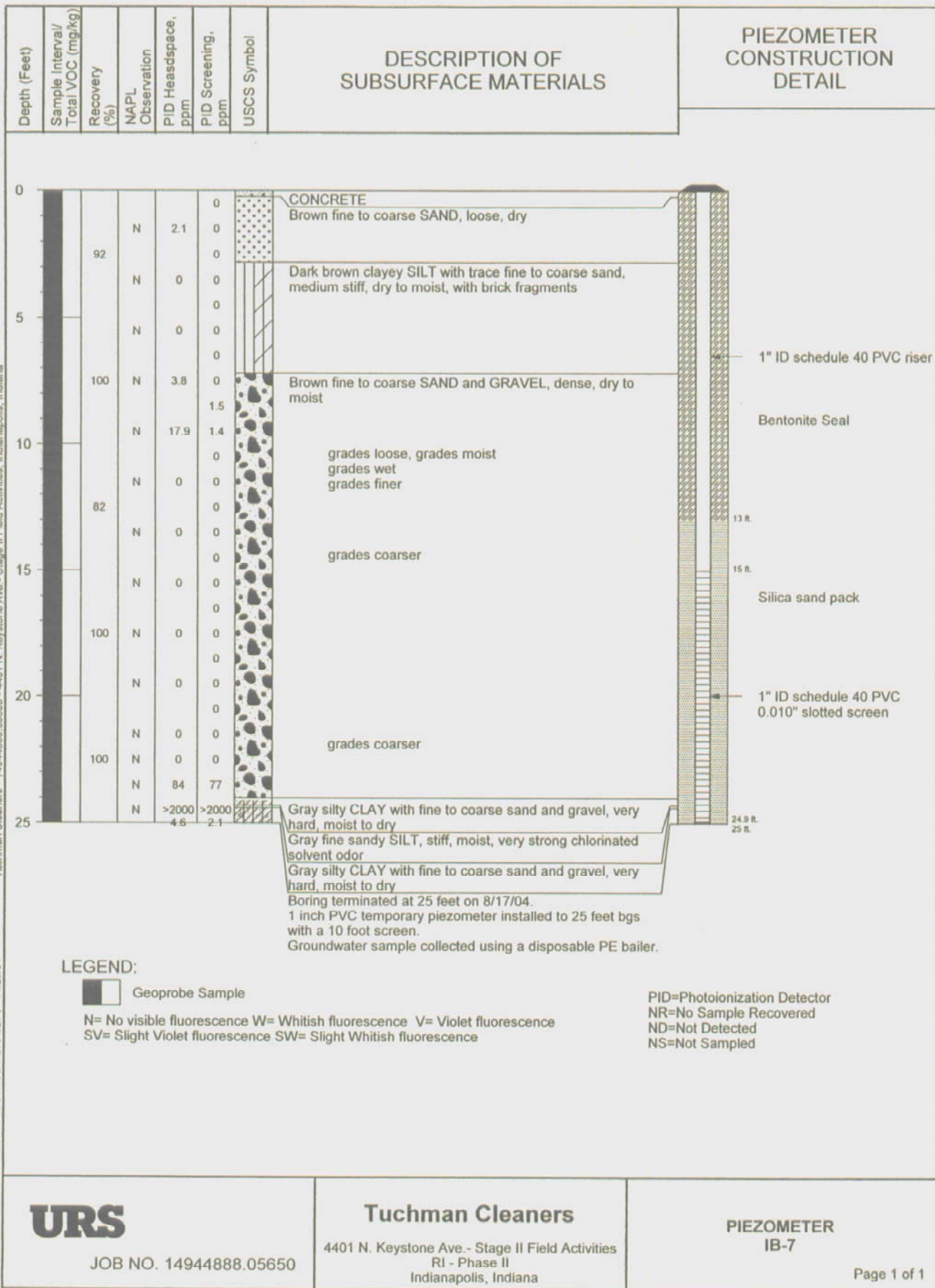
4401 N. Keystone Ave. - Stage II Field Activities
RI - Phase II
Indianapolis, Indiana

**PIEZOMETER
IB-6**

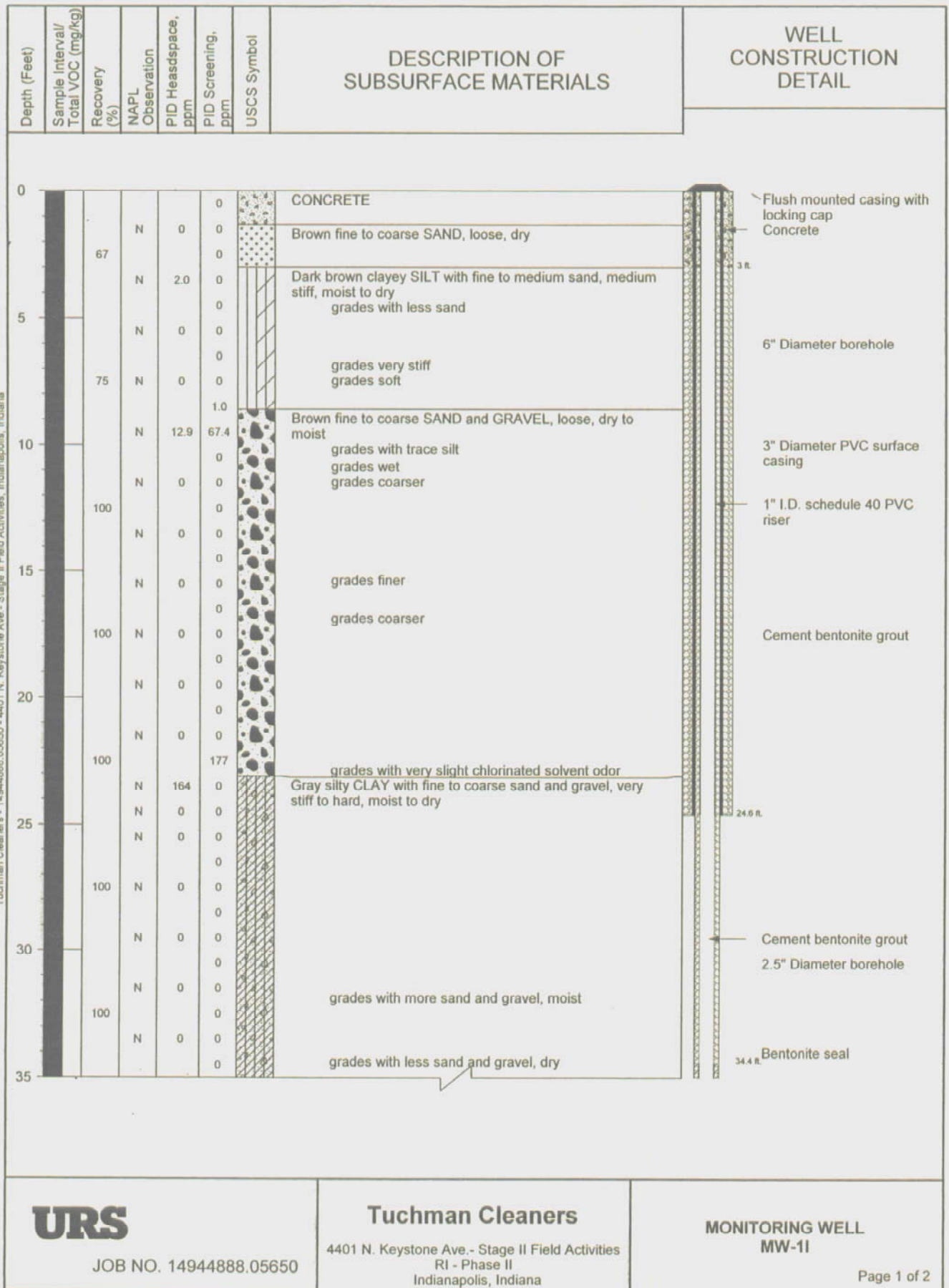
Page 1 of 1

Tuchman Cleaners - 14944888.05650 - Stage II Field Activities, Indianapolis, Indiana

TUCHMAN LOG PHASE2 TUCHMAN STAGE II 2004.GPJ 11/23/04



Tuchman Cleaners - 1494888.05650 - 4401 N. Keystone Ave. - Stage II Field Activities, Indianapolis, Indiana



URS

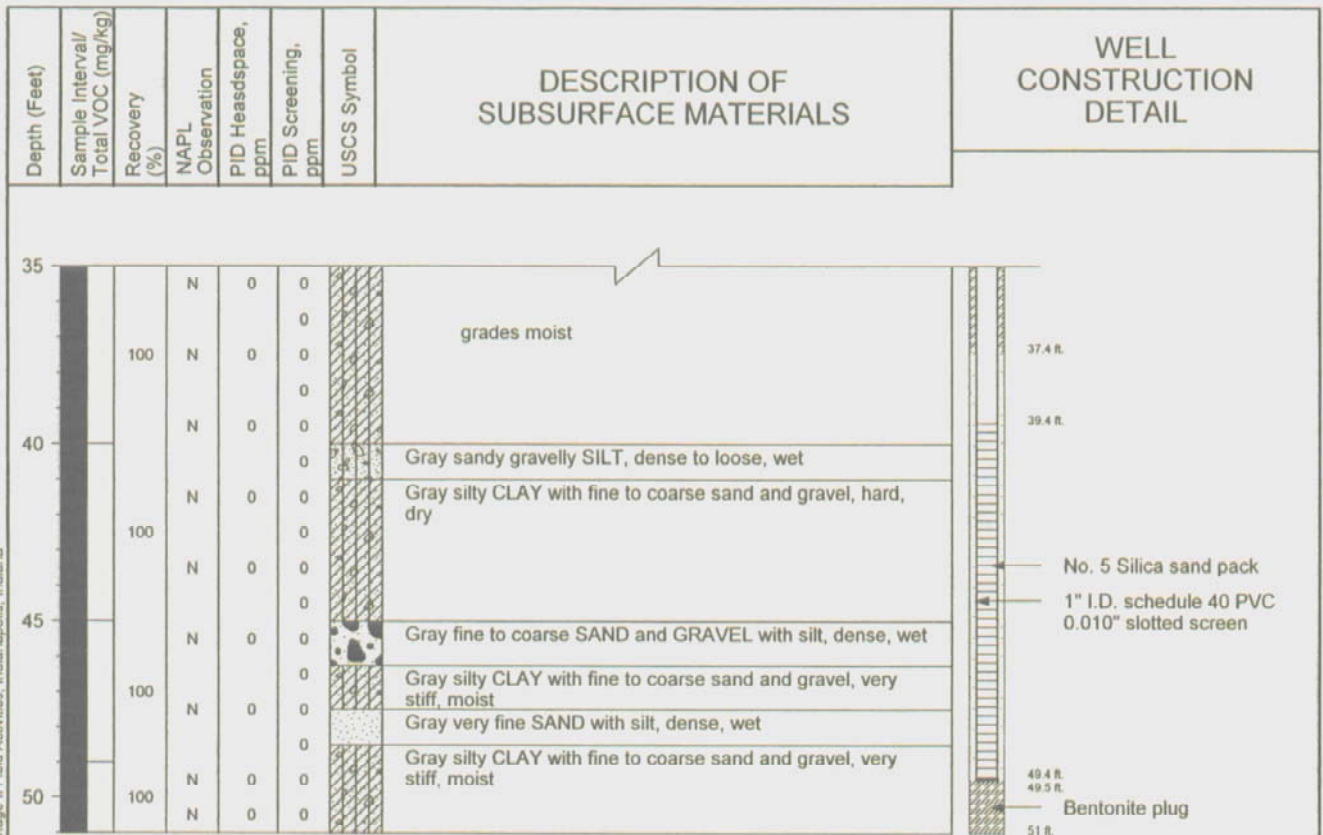
JOB NO. 14944888.05650

Tuchman Cleaners

4401 N. Keystone Ave. - Stage II Field Activities
RI - Phase II
Indianapolis, Indiana

**MONITORING WELL
MW-11**

Page 1 of 2



Boring advanced to 24.6 feet using 4.25 inch I.D. hollow stem augers on 8/17/04.
 3 inch diameter PVC installed to 24.6 feet and sealed with cement-bentonite grout on 8/17/04.
 2.5 inch diameter geoprobe dual-tube sampler advanced to 51 feet on 8/18/04.
 Boring terminated at 51 feet on 8/18/04.
 1 inch diameter PVC piezometer installed to 49.5 feet bgs with a 10 foot screen on 8/18/04.

LEGEND:



Geoprobe Sample

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
 SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
 NR=No Sample Recovered
 ND=Not Detected
 NS=Not Sampled

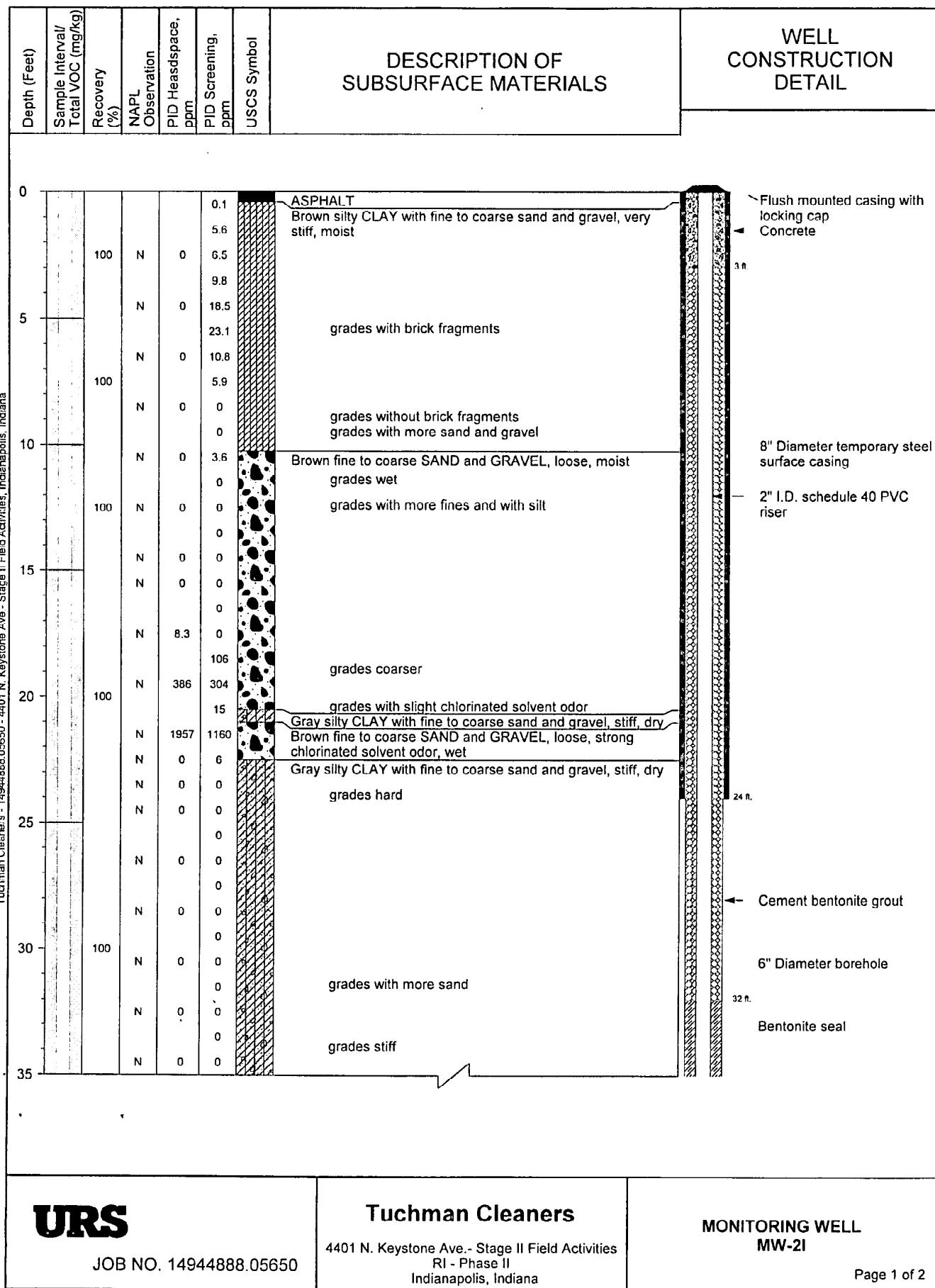
URS

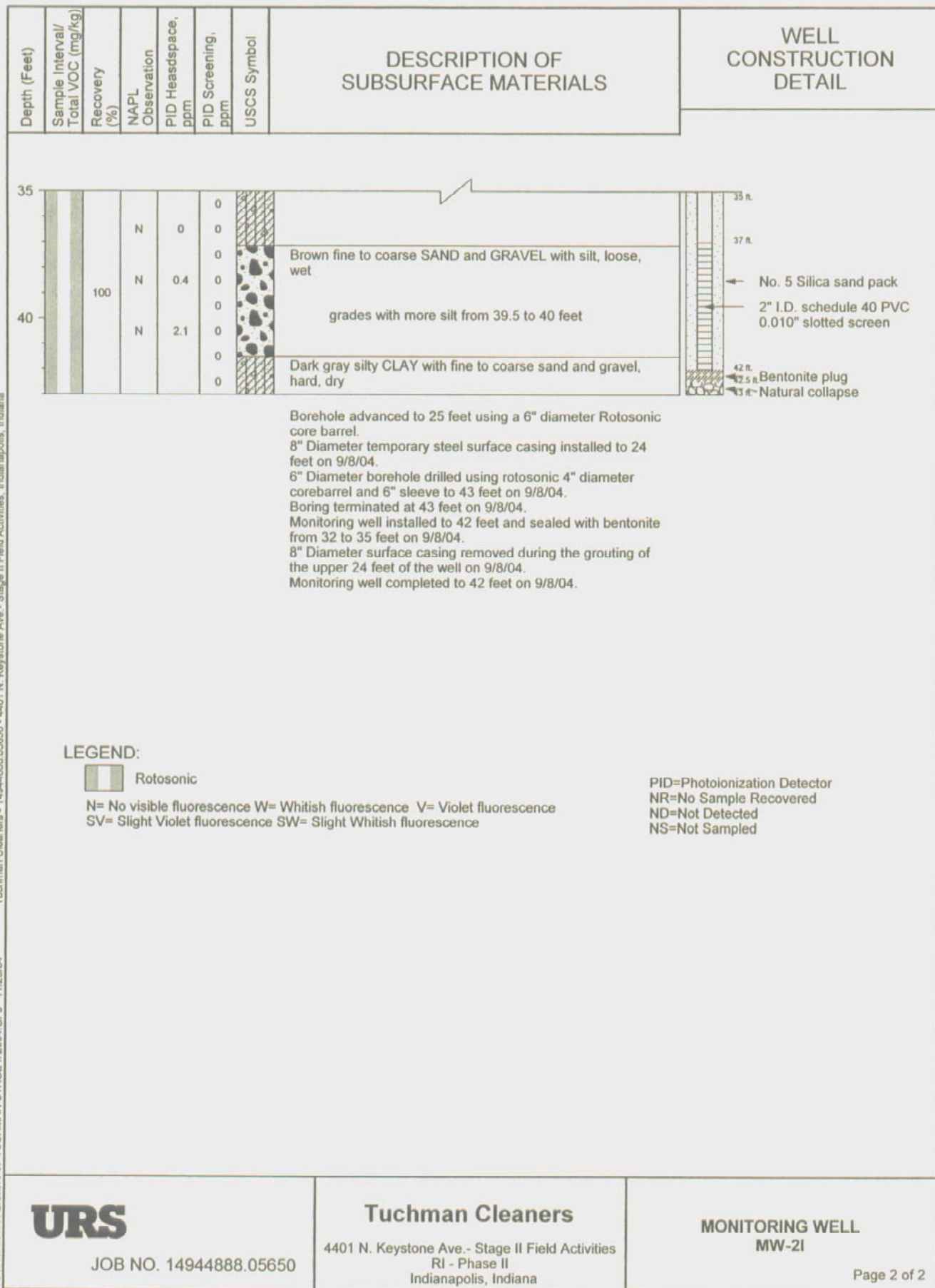
JOB NO. 14944888.05650

Tuchman Cleaners

4401 N. Keystone Ave. - Stage II Field Activities
 RI - Phase II
 Indianapolis, Indiana

**MONITORING WELL
 MW-11**

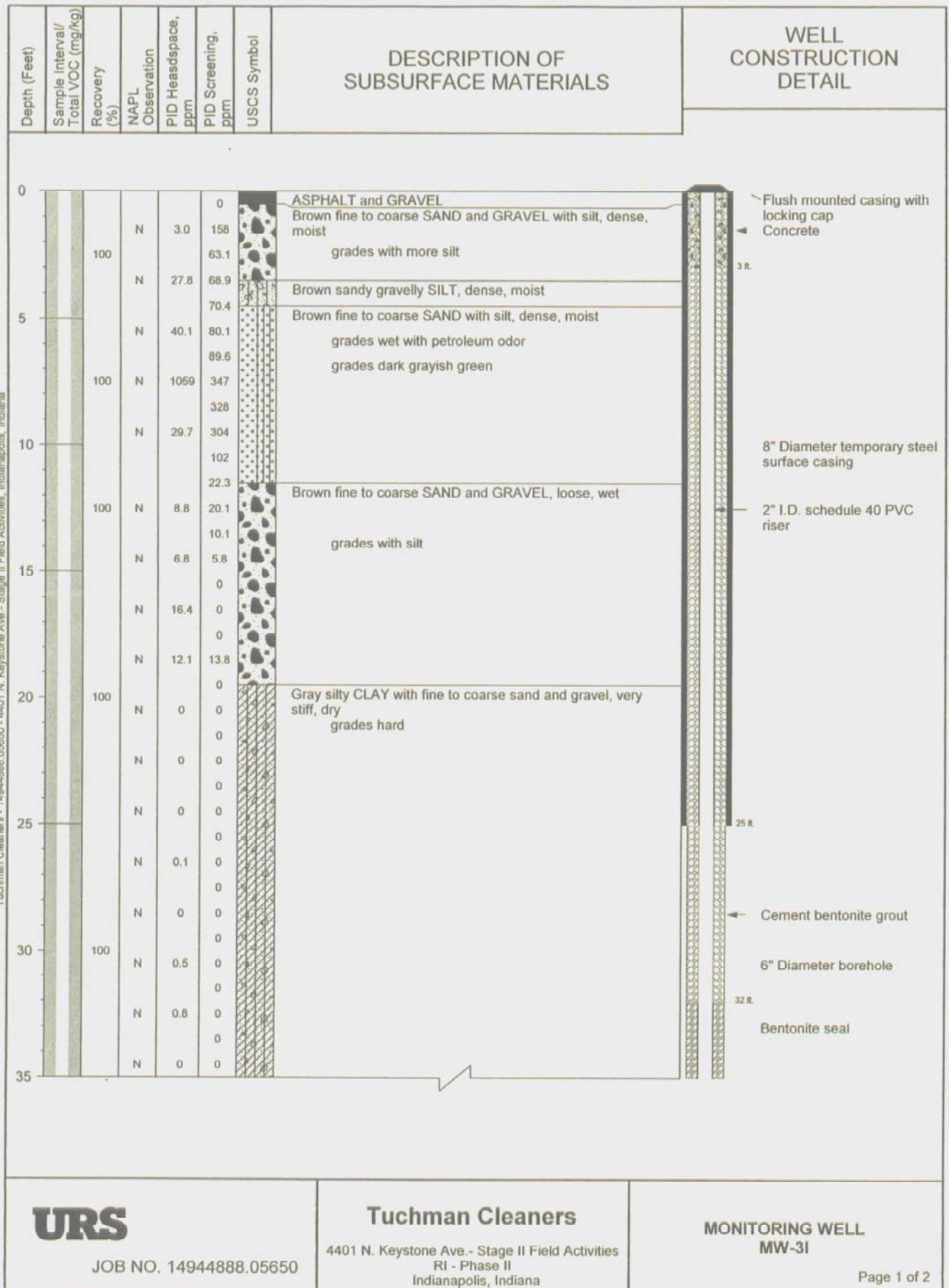




Tuchman Cleaners - 14944888.05650 - 4401 N. Keystone Ave. - Stage II Field Activities, Indianapolis, Indiana

TUCHMAN MW-2I&MW-3I TUCHMAN STAGE II 2004 GPJ 11/23/04

Tuchman Cleaners - 14944888.05650 - 4401 N. Keystone Ave. - Stage II Field Activities, Indianapolis, Indiana



URS

JOB NO. 14944888.05650

Tuchman Cleaners

4401 N. Keystone Ave. - Stage II Field Activities
RI - Phase II
Indianapolis, Indiana

**MONITORING WELL
MW-31**

Page 1 of 2

Depth (Feet)	Sample Interval/ Total VOC (mg/kg)	Recovery (%)	NAPL Observation	PID Headspace, ppm	PID Screening, ppm	USCS Symbol	DESCRIPTION OF SUBSURFACE MATERIALS	WELL CONSTRUCTION DETAIL
35			N	0.8	0		grades with more coarse gravel from 35.5 to 36.5 feet	35 ft.
			N	1.3	0		grades wet	37 ft.
			N	0.2	1.1		grades with more coarse gravel	
40	100		N	0.5	0		Gray fine to coarse SAND and GRAVEL, loose, wet	← No. 5 Silica sand pack
							Gray silty CLAY with fine to coarse gravel, hard, dry	← 2" I.D. schedule 40 PVC 0.010" slotted screen
								42 ft.
45			N	0.3	0			← Bentonite plug
								45 ft.

Borehole advanced to 25 feet using a 6" diameter Rotosonic core barrel.
 8" Diameter temporary steel surface casing installed to 25 feet on 9/8/04.
 6" Diameter borehole drilled using rotosonic 4" diameter corebarrel and 6" sleeve to 45 feet on 9/9/04.
 Boring terminated at 45 feet on 9/9/04.
 Monitoring well installed to 42 feet and sealed with bentonite from 32 to 35 feet on 9/9/04.
 8" Diameter surface casing removed during the grouting of the upper 24 feet of the well on 9/9/04.
 Monitoring well completed to 42 feet on 9/9/04.

LEGEND:



Rotosonic

N= No visible fluorescence W= Whitish fluorescence V= Violet fluorescence
 SV= Slight Violet fluorescence SW= Slight Whitish fluorescence

PID=Photoionization Detector
 NR=No Sample Recovered
 ND=Not Detected
 NS=Not Sampled

URS

JOB NO. 14944888.05650

Tuchman Cleaners

4401 N. Keystone Ave.- Stage II Field Activities
 RI - Phase II
 Indianapolis, Indiana

**MONITORING WELL
 MW-31**

APPENDIX B
IDNR WELL LOGS

perjury that the information submitted
with is to the best of my knowledge and
belief, true, accurate and complete.

John E. [Signature]

Date 3/18/04



RECORD OF WATER WELL

State Form 35680 (R4 / 4-92)

Mail complete record within 30 days to:
INDIANA DEPARTMENT OF NATURAL RESOURCES
Division of Water
402 W. Washington St., Rm. W264
Indianapolis, IN 46204
(317) 232-4160

Fill in completely

WELL LOCATION

County where drilled Marion	Civil township	Township	Range	Section
---------------------------------------	----------------	----------	-------	---------

Driving directions to the well location (include county road names, number, subdivision lot number with consideration to intersecting road and trip origination). There is space for a map on reverse side.

4401 North Keystone
Indpls IN

OWNER-CONTRACTOR

Name of well owner Tuchman Cleaners	Telephone number 317-545-4321
---	---

Address (number and street, city, state, ZIP code) 4401 North Keystone Indianapolis IN
--

Name of building contractor	Telephone number
-----------------------------	------------------

Address (number and street, city, state, ZIP code)
--

Name of drilling contractor American Drilling Services LLC	Telephone number 317-571-4088
--	---

Address (number and street, city, state, ZIP code) 8500 Georgetown Rd Indianapolis Indiana 46268
--

Name of equipment operator Steve Sikora	License number 293	Date of completion 8/18/04
---	------------------------------	--------------------------------------

CONSTRUCTION DETAILS

WELL LOG

Use of well: <input checked="" type="checkbox"/> Home <input type="checkbox"/> Public supply <input type="checkbox"/> Industry <input type="checkbox"/> Stock <input type="checkbox"/> Test <input type="checkbox"/> Other (specify): Monitoring <input type="checkbox"/> Irrigation	FORMATIONS: Type of material	From (feet)	To (feet)
Method of drilling: <input checked="" type="checkbox"/> Rotary <input type="checkbox"/> Cable tool <input type="checkbox"/> Jet <input type="checkbox"/> Rev. rotary <input type="checkbox"/> Bucket rig <input checked="" type="checkbox"/> Other HSA	Piezometer mw-11		
Casing length 39.5 feet Material PVC Diameter 1" inches	Concrete	0.0	1.5
Screen length 10.0 feet Material PVC Diameter 1" inches	Brn cly Si w/ sa	1.5	10.0
Screen slot size 010	Brn Dry Sa + grul	10.0	23.0
Depth of pump setting NA	Grly till	23.0	40.0
Type of pump: <input type="checkbox"/> Shallow-well jet <input type="checkbox"/> Deep-well jet <input type="checkbox"/> Other (specify): <input type="checkbox"/> Submersible	Grly till w/ moist sa + si seams	40.0	51.0

WELL CAPACITY TEST

Test one: <input type="checkbox"/> Bailing <input type="checkbox"/> Air <input type="checkbox"/> Pumping	Test rate: _____ gpm _____ hrs.
Drawdown: _____ feet	Static level: (depth of water) _____ feet

GROUTING INFORMATION

WELL ABANDONMENT

Grout material: port	Depth of grout: From 31.0 to 0.5	Sealing material: From _____ to _____	Depth of seal: From _____ to _____
Method of installation: man	Number of bags used: 4	Method of abandonment: _____	Number of bags used: _____

(Additional space for well log on reverse side)

I hereby swear or affirm, under the penalties of perjury that the information submitted herewith is to the best of my knowledge and belief: true, accurate and complete

Signature of owner or authorized representative

Steve Sikora

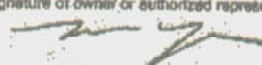
Date
8/18/04

RECORD OF WATER WELL

MW-21

Mail complete record within 30 days to:

Indiana Department of Natural Resources
Division of Water
402 W. Washington St., Rm W264
Indianapolis, IN 46204
Telephone number (317) 232-4160

WELL LOCATION				
County where drilled Marion	Civil Township Washington	Township 16N	Range 4E	Section 17
Drilling directions to the well location (include county road names, number, subdivision lot number with consideration to intersecting road and trip origins). There is a space for a map on the reverse.				
See Attached Map				
OWNER - CONTRACTOR				
Name of Well Owner Tuchman Cleaners			Telephone Number 317-545-4321	
Address (number and street, city, state, ZIP code) 4401 North Keystone Ave. Indianapolis, IN 46205				
Name of building contractor URS Corporation			Telephone Number 513-651-3440	
Address (number and street, city, state, ZIP code) 36th East 7th Street Suite 2550 Cincinnati, OH 45202				
Name of drilling contractor Boart Longyear Environmental Drilling			Telephone Number 800-430-9834	
Address (number and street, city, state, ZIP code) 5815 Churchman Avenue Suite 2 Indianapolis, IN 46203				
Name of equipment operator Kevin Smith		License number 2019	Date of Installation 09/08/04	
CONSTRUCTION DETAILS			WELL LOG	
Use of well: <input type="checkbox"/> Home <input type="checkbox"/> Industry <input checked="" type="checkbox"/> Test <input type="checkbox"/> Irrigation <input type="checkbox"/> Public supply <input type="checkbox"/> Stock <input type="checkbox"/> Other (Specify)			FORMATIONS: Type of material	
Method of drilling: <input type="checkbox"/> Rotary <input type="checkbox"/> Jet <input type="checkbox"/> Bucket Rig <input type="checkbox"/> Cable tool <input type="checkbox"/> Rev. Rotary <input checked="" type="checkbox"/> Sonic			From (feet)	
Casing length 37 feet			To (feet)	
Material PVC			Asphalt	
Diameter 2 inches			0	
Screen length 5 feet			M/C Sand & Gravel	
Material PVC			0.5	
Diameter 2 inches			2	
Screen slot size 0.010			Brown Clay	
Total depth of well 42' bgs			2	
Depth of pump setting			15	
Water quality (clear, cloudy, odor, etc.)			20	
Type of pump: <input type="checkbox"/> Shallow-well jet <input type="checkbox"/> Other (specify): <input type="checkbox"/> Submersible <input type="checkbox"/> Deep-well jet			Brown Clay	
WELL CAPACITY TEST			20	
Check one: <input type="checkbox"/> Bailing <input type="checkbox"/> Pumping			35	
Test Rate gpm hours			42	
Drawdown feet (depth of water) feet			42	
Static rate			43	
GROUTING INFORMATION				
Grouting materials Cement/Bent.				
Depth of grout From 31 to 1				
Method of installation Number of bags used 4				
Bailing materials Depth of seal feet to feet				
Method of installation Number of bags used				
Treated/Purified				
I hereby swear or affirm, under the penalties for perjury that the information submitted herein is to the best of my knowledge and belief, true, accurate and complete.			Signature of owner or authorized representative  Date 09/17/04	

FOR ADMINISTRATIVE USE ONLY (Well driller does not fill out)									
County	Township	Range	1/4		1/4		Section		
Topo Map	Ft. W of EL		Ground elevation		Name of subdivision				
Field located By	Date	Ft. N of SL		Depth to bedrock		Lot number			
Courthouse location By	Date	Ft. E of WL		Bedrock Elevation		U.T.M.			
Location accepted w/o verification by		Ft. S of NL		Aquifer elevation					

(continued from front side)

WELL LOG FORMATIONS TYPE OF MATERIAL	FROM	TO	SKETCH SHOWING LOCATION	
			(Locate with reference to highways intersecting county roads and distinctive landmarks)	

See Map Attached

S

RECORD OF WATER WELL

MW-31

Must complete record within 30 days of:

Indiana Department of Natural Resources
Division of Water
402 W. Washington St., Rm W264
Indianapolis IN 46204
Telephone number (317) 232-4160

WELL LOCATION				
County where drilled Marion	Civil Township Washington	Township 16N	Range 4E	Section 17
Drilling directions to the well location (include county road names, number, subdivision lot number with consideration to intersecting road and trip origins). There is a space for a map on the reverse.				
See Attached Map				
OWNER/CONTRACTOR				
Name of Well Owner Tuchman Cleaners			Telephone Number 317-545-4321	
Address (number and street, city, state, ZIP code) 4401 North Keystone Ave. Indianapolis, IN 46205				
Name of building contractor URS Corporation			Telephone Number 513-651-3440	
Address (number and street, city, state, ZIP code) 36th East 7th Street Suite 2550 Cincinnati, OH 45202				
Name of drilling contractor Boart Longyear Environmental Drilling			Telephone Number 800-430-9834	
Address (number and street, city, state, ZIP code) 5815 Churchman Avenue Suite 2 Indianapolis, IN 46203				
Name of equipment operator Kevin Smith		License number 2019	Date of installation 09/09/04	
CONSTRUCTION DETAILS			WELL LOG	
Use of well: <input type="checkbox"/> Home <input type="checkbox"/> Industry <input checked="" type="checkbox"/> Test <input type="checkbox"/> Irrigation <input type="checkbox"/> Public supply <input type="checkbox"/> Stock <input type="checkbox"/> Other (Specify)			FORMATIONS: Type of material Asphalt	
Method of drilling: <input type="checkbox"/> Rotary <input type="checkbox"/> Jet <input type="checkbox"/> Bucket Rig <input type="checkbox"/> Cable tool <input type="checkbox"/> Rev. Rotary <input checked="" type="checkbox"/> Sonic			M/C Sand & Gravel	
Casing length 37 feet	Material PVC	Diameter 2 inches	Brown Clay	
Screen length 5 feet	Material PVC	Diameter 2 inches	M/C Sand & Gravel	
Screen slot size 0.010	Total depth of well 42' bgs	Brown Clay		
Depth of pump setting	Water quality (clear, cloudy, odor, etc.)	Brown M/C Sand		
Type of pump <input type="checkbox"/> Submersible <input type="checkbox"/> Shallow-well jet <input type="checkbox"/> Other (specify)		Gry Clay		
WELL CAPACITY TEST Check one: <input type="checkbox"/> Air <input type="checkbox"/> Pumping <input type="checkbox"/> Bailing				
Drawdown	Static rate			
feet	(depth of water) feet			
GROUTING INFORMATION		WELL ABANDONMENT		
Grouting materials Cement/Bent.	Depth of grout From 31 to 1	Reason for abandonment		
Method of installation	Number of bags used 4	Reason for abandonment		
Tremie Pumped		(Additional space for well log on reverse side)		
I hereby swear or affirm, under the penalties for perjury that the information submitted herein is to the best of my knowledge and belief, true, accurate and complete.		Signature of owner or authorized representative		Date 09/17/04

County		Township	Range	1/4	1/4	Section
FOR ADMINISTRATIVE USE ONLY (well owner does not fill this)						
Topo Map	FL W of EL		Ground elevation		Name of subdivision	
Field located	FL N of SL		Depth to bedrock		Lot number	
By	Date	FL E of WL	Bedrock Elevation		U.T.M.	
Courthouse location	Date	FL S of NL	Aquifer elevation			
By	Location accepted who verification by					

(continued from front side)

WELL LOG	FROM	TO	SKETCH SHOWING LOCATION
FORMATION - type of material	FEET	FEET	Locate with reference to highway, township, county roads and distinctive landmarks

See Map Attached
S

APPENDIX C
SURVEY DATA
BEACON SURVEYING & ENGINEERING

URS Corporation
Tuchman Cleaners
4401 N. Keystone Ave.
Indianapolis, IN
4/21/2004
DCW
Beacon Project No: 03-0015.01



Description	Northing (ft.)	Easting (ft.)	Casing Elevation (ft.)	Ground Elevation (ft.)
OSP 1	1671495.86	199951.27	-	734.06
OSP 2	1671307.01	200016.27	-	730.80
OSP 3	1671163.77	199998.85	727.37	727.56
OSP 4	1671497.80	199827.76	737.21	737.50
OSP 5	1671315.07	199827.19	-	737.69
OSP 6	1671165.74	199829.14	-	734.42
OSP 7	1671488.76	199665.45	-	738.11
OSP 8	1671328.24	199626.95	-	739.42
OSP 9	1671164.87	199637.71	737.68	737.96
OSP 10	1671590.66	200207.12	-	729.05
OSP 11	1671338.57	199502.17	-	739.12
OSP 12	1671178.99	199453.73	-	739.01
OSP 13	1671639.65	200069.59	731.37	731.62
OSP 14	1671151.99	200186.28	-	728.02
OSP 15	1671207.49	200399.63	727.34	727.52
OSP 16	1671350.58	200500.86	-	728.04
OSP 17	1671656.48	200712.87	-	728.65
PDP 10D	1671641.97	200399.29	727.99	728.83

Surveyor's Statement

I, Daniel G. Kovert, a registered land surveyor in the state of Indiana, do hereby state that the locations and elevations shown above were determined under my supervision. The horizontal locations shown above are based on Indiana State Plane Coordinates, East Zone for section corner locations as shown by the Marion County, Indiana Surveyor's Office. The elevations shown are based on Indiana Flood Control and Water Resources Commission bench mark MAR 38 with an elevation of 726.399 (1929 datum).

Note

Elevations shown are at the highest point on the casing.

APPENDIX D
ANALYTICAL REPORTS
(Submitted on CD)